

# PRACTICE EXAM 9: CSCS FULL-LENGTH SIMULATION

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## SECTION 1 — SCIENTIFIC FOUNDATIONS

95 Questions | 1.5 Hours Recommended

### EXERCISE SCIENCE (Questions 1–52)

1. An exercise physiologist analyzes muscle biopsies from identical twins. Twin A has trained as a competitive sprinter for 10 years and shows 20% Type I, 60% Type IIa, and 20% Type IIx fibers. Twin B has trained as a marathon runner for 10 years and shows 68% Type I, 28% Type IIa, and 4% Type IIx fibers. Which conclusion about fiber type distribution is best supported by this comparison?

- A. Both twins must have started with identical fiber distributions that fully converted through training
- B. Environmental factors such as training are the sole determinant of fiber type composition
- C. Fiber type composition is entirely fixed at birth and training produces no measurable change
- D. Fiber type distribution has a significant genetic component, but chronic training influences the proportions — particularly the well-documented IIx-to-IIa shift in the sprinter and the reduced IIx in both trained athletes

2. During a maximal isometric knee extension, the athlete produces 400 N·m of peak torque. The strength and conditioning specialist notes that this measurement was taken at 60 degrees of knee flexion. If the test were repeated at 30 degrees of knee flexion (a more extended position), the peak torque would most likely change in which direction?

- A. Peak torque would increase because the quadriceps are in a more shortened position with greater cross-bridge overlap

- B. Peak torque would decrease because the quadriceps are in a more extended (shortened) position where actin-myosin overlap becomes suboptimal and the moment arm of the muscle changes — the length-tension relationship predicts reduced force at lengths deviating from optimum
- C. Peak torque would remain identical because joint angle has no effect on isometric force production
- D. Peak torque would exactly double at 30 degrees compared to 60 degrees of knee flexion

3. A strength and conditioning specialist evaluates a novice athlete's training response. In weeks 1 through 8, the athlete's squat 1RM increased 50% with only 2% hypertrophy measured by ultrasound. In weeks 9 through 20, the rate of strength gain slowed to 8% while hypertrophy increased to 14%. This two-phase adaptation pattern is explained by which physiological principle?

- A. Early strength gains are predominantly neural (improved recruitment, rate coding, coordination), while later gains are increasingly driven by structural hypertrophy — the shift from neural to structural adaptation is characteristic of the progression from novice to intermediate training status
- B. The athlete developed a medical condition during weeks 9-20 that impaired neural adaptation
- C. Hypertrophy always precedes neural adaptation in all populations regardless of training status
- D. Both phases are entirely attributable to changes in motivation rather than physiological adaptation

4. The cross-bridge cycle consists of four sequential steps that repeat during muscle contraction. During which step does the myosin head generate the force that pulls actin toward the center of the sarcomere?

- A. Cross-bridge detachment, during which a new ATP molecule binds to the myosin head and breaks the actin-myosin bond
- B. Myosin reactivation, during which ATP is hydrolyzed and the myosin head returns to its cocked position
- C. The power stroke, during which the myosin head pivots and changes conformation while releasing ADP and inorganic phosphate, pulling the actin filament toward the M-line
- D. Cross-bridge formation, during which the energized myosin head first attaches to the exposed binding site on actin

5. The Golgi tendon organ (GTO) and muscle spindle produce opposing reflexive responses. The GTO detects tension and produces autogenic inhibition, while the spindle detects length change and produces the stretch reflex. Chronic heavy resistance training modifies GTO function in which specific way that contributes to strength gains?

- A. Training completely eliminates all GTOs from the musculotendinous junction through structural remodeling
- B. Training increases GTO sensitivity so that inhibition activates at lower tension thresholds
- C. Training has no measurable effect on GTO function under any loading condition
- D. Training reduces the GTO's inhibitory influence, allowing trained athletes to voluntarily produce force closer to the structural capacity of their musculotendinous units — a neural disinhibition that contributes to strength gains beyond hypertrophy

6. An athlete performs a maximal vertical jump from a force plate. Peak ground reaction force is 3,200 N with a body weight of 882 N ( $90 \text{ kg} \times 9.81$ ). The net upward force is 2,318 N. If a second athlete of identical weight produces only 2,400 N of peak GRF, the net upward force drops to 1,518 N. The first athlete will achieve a higher jump primarily because of which factor?

- A. The first athlete has greater flexibility allowing a deeper countermovement during the jump
- B. Greater net upward force (2,318 vs. 1,518 N) produces greater upward acceleration and therefore greater takeoff velocity and jump height
- C. Both athletes will achieve identical heights because they have the same body weight
- D. The second athlete will jump higher because lower GRF indicates more efficient technique

7. An exercise physiologist conducts a graded treadmill test and records blood lactate at each stage. At 9 km/h, lactate is 1.2 mmol/L. At 11 km/h, 1.8 mmol/L. At 13 km/h, 5.2 mmol/L. At 14 km/h, 9.4 mmol/L. The exponential rise between 11 and 13 km/h identifies which physiological marker?

- A. The depletion of all intramuscular phosphocreatine at this specific running speed
- B. The absolute  $\text{VO}_{2\text{max}}$  ceiling beyond which no oxygen consumption is possible

C. The lactate threshold — the running speed where lactate production began exceeding the body's clearance capacity, indicating the transition to unsustainable metabolic conditions

D. The complete deactivation of all Type II motor units at this exercise intensity

8. An athlete performs a PNF contract-relax hamstring stretch. After a 6-second isometric contraction against resistance, the hamstrings are passively stretched to a greater range than was achievable before the contraction. This increased stretch range is the result of which neurological mechanism?

A. Autogenic inhibition from the GTO — the isometric contraction generated high tension that activated the GTO, which reflexively reduced alpha motor neuron activity to the hamstrings through an inhibitory interneuron, temporarily decreasing their tone and resistance to stretch

B. The stretch reflex was amplified by the contraction, producing a stronger involuntary shortening

C. Permanent structural lengthening of the hamstring muscle fibers occurred during the 6-second hold

D. Reciprocal inhibition from the quadriceps spindle caused the hamstrings to relax

9. A 45-second all-out Wingate cycling test produces severe quadriceps burning, blood lactate of 16 mmol/L, and a 35% decline in power output from peak to final 5 seconds. The dominant energy system and primary cause of fatigue during this effort are which of the following?

A. Beta-oxidation of fat producing toxic waste products that impaired the quadriceps function

B. The phosphagen system exclusively for the entire 45-second duration without glycolytic contribution

C. Oxidative phosphorylation through the electron transport chain at moderate aerobic intensity

D. Anaerobic glycolysis — rapid glycogen breakdown producing hydrogen ions that accumulate, reduce intracellular pH, and impair cross-bridge cycling and enzymatic function

10. During a 4-hour cycling ride at 60% of  $VO_{2max}$ , an athlete's respiratory exchange ratio (RER) starts at 0.87 and progressively decreases to 0.77 by the final hour. This RER decrease reflects which metabolic shift?

A. An increase in anaerobic glycolytic metabolism during the final hour of the ride

B. A progressive shift from carbohydrate toward greater fat oxidation as glycogen stores deplete — as carbohydrate becomes less available, the body relies increasingly on fat, producing the lower CO<sub>2</sub>-to-O<sub>2</sub> ratio

C. A shift toward exclusive protein oxidation replacing all other fuels during the fourth hour

D. No change in substrate utilization because RER does not reflect fuel source under any condition

11. The electron transport chain (ETC) produces the vast majority of ATP during aerobic metabolism through oxidative phosphorylation. The ETC's function depends absolutely on which molecule serving as the final electron acceptor?

A. Carbon dioxide, which is recycled from the Krebs cycle back into the ETC for reprocessing

B. NADH, which serves as the final product of the chain rather than an input substrate

C. Oxygen — combining with electrons and hydrogen ions to form water; without it, the ETC halts entirely and aerobic ATP production ceases

D. Lactate, which donates electrons directly to Complex I at the start of the chain

12. A strength and conditioning specialist prescribes conditioning for a team of 100-meter sprinters. The sprint event lasts 10 to 12 seconds at maximal intensity. Which energy system dominates ATP production during this event, and what work-to-rest ratio supports its development?

A. The phosphagen system dominates, with a work-to-rest ratio of 1:12 to 1:20 (approximately 2-4 minutes of rest per 10-second sprint) to allow near-complete phosphocreatine resynthesis between efforts

B. The glycolytic system dominates because all events lasting longer than 5 seconds are glycolytic

C. The oxidative system dominates because sprinting requires sustained aerobic metabolism

D. All three systems contribute equally with a 1:1 ratio providing optimal development

13. Fat oxidation yields approximately 129 ATP per molecule of palmitate versus 36-38 from glucose. Despite this superior yield, fat cannot be the primary fuel for high-intensity exercise because of which fundamental limitation?

- A. Fat stores are too small to provide meaningful energy during exercise of any type
- B. Fat molecules cannot physically enter the mitochondria under any metabolic condition
- C. Fat oxidation produces toxic waste products that impair muscular contraction at all intensities
- D. Fat oxidation produces ATP at a rate too slow to match the rapid energy demand of high-intensity exercise — the rate limitation, not yield, determines which substrate dominates

14. During progressive exercise from rest to maximal intensity, stroke volume increases until approximately 40-60% of  $\text{VO}_2\text{max}$ , then plateaus. Further cardiac output increases beyond this plateau depend primarily on which cardiovascular mechanism?

- A. Continued structural enlargement of the left ventricle during the graded exercise test
- B. Continued increases in heart rate through sympathetic nervous system activation until approaching the age-predicted maximum
- C. Progressive decreases in blood volume that concentrate oxygen delivery to the heart
- D. Conversion of venous blood to arterial blood through pulmonary bypass mechanisms

15. Newton's Third Law states that for every action there is an equal and opposite reaction. During a barbell back squat, the athlete pushes downward against the floor through their feet. The floor pushes back with an equal upward force. This upward ground reaction force must exceed which threshold for the athlete to accelerate upward out of the bottom position?

- A. The force must exceed zero Newtons for any upward movement to begin
- B. The force must equal the weight of the barbell alone without including the athlete's body mass
- C. The ground reaction force must exceed the combined weight of the athlete plus the barbell (total system weight) for net upward acceleration to occur
- D. The force required for upward movement is independent of the athlete's body mass or the load

16. A biomechanical analysis of an athlete's conventional deadlift reveals that the sticking point occurs at approximately mid-shin height where the torso is inclined forward approximately 60 degrees from vertical. The strength and conditioning specialist identifies that the horizontal distance from the barbell to the L4-L5 vertebral segment is at its maximum at this position. This sticking point exists because of which biomechanical principle?

- A. Torque = force  $\times$  moment arm — the maximum horizontal distance between the bar and the lumbar spine creates the greatest moment arm, which produces the highest flexion torque demand on the hip and back extensors at this specific point in the range of motion
- B. The quadriceps reach their absolute shortest length at mid-shin and can produce zero force
- C. Gravitational force on the barbell triples when the bar reaches mid-shin height
- D. The athlete's grip always fails at exactly this bar position regardless of grip strength training

17. The ventilatory threshold during a graded exercise test is identified as the intensity where ventilation increases disproportionately relative to oxygen consumption. This non-linear ventilatory increase occurs because the bicarbonate buffering system generates additional CO<sub>2</sub> that must be expelled. The buffering system is responding to which metabolic event?

- A. Complete depletion of all intramuscular phosphocreatine triggering a ventilatory alarm response
- B. Direct release of CO<sub>2</sub> from adipose tissue during fat oxidation at high exercise intensities
- C. Deactivation of all chemoreceptors that normally regulate the rate and depth of breathing
- D. Hydrogen ion accumulation from glycolytic metabolism — the bicarbonate system converts H<sup>+</sup> and HCO<sub>3</sub><sup>-</sup> into H<sub>2</sub>O and CO<sub>2</sub> to maintain blood pH, and the additional CO<sub>2</sub> requires increased ventilation for removal

18. The force-velocity relationship for concentric muscle actions demonstrates an inverse relationship: as velocity increases, maximal force decreases. A strength and conditioning specialist wants to develop an athlete's maximal power output. According to this relationship, peak power (the product of force and velocity) is achieved at approximately which region of the curve?

- A. At the absolute maximum force end using near-maximal loads at the slowest possible velocity

- B. At approximately 30-60% of maximal force, where the combination of moderate force and moderate-to-high velocity produces the greatest power product
- C. At the absolute maximum velocity end using zero external load for the fastest possible movement
- D. Power is identical at every point on the curve because force and velocity always multiply to the same product

19. An athlete's passive shoulder flexion measured with a goniometer and external force is 178 degrees. Their active shoulder flexion produced by their own muscular effort is 162 degrees. The 16-degree difference between these measurements represents which principle?

- A. A structural bone abnormality preventing all active motion beyond 162 degrees of shoulder flexion
- B. A complete rotator cuff rupture preventing voluntary activation of the shoulder flexors
- C. The difference between passive and active ROM — external force can move the joint beyond the limit of voluntary muscular effort, reflecting the neuromuscular and motor control limits of active motion
- D. An error in the goniometer calibration that consistently overestimates passive ROM by exactly 16 degrees

20. Chronic endurance training produces eccentric cardiac hypertrophy characterized by an enlarged left ventricular chamber. This structural adaptation directly increases maximal stroke volume. A well-trained endurance athlete has a resting stroke volume of 115 mL/beat and a resting heart rate of 46 bpm. The resting cardiac output is approximately which value?

- A. 5,290 mL/min (approximately 5.3 L/min) — calculated as  $115 \text{ mL} \times 46 \text{ bpm}$ , demonstrating that the high resting stroke volume allows normal cardiac output to be maintained with fewer beats
- B. 115 mL/min calculated by using only the stroke volume as the cardiac output
- C. 46 mL/min calculated by using only the heart rate as the cardiac output value
- D. 10,580 mL/min calculated by doubling the product of stroke volume and heart rate

21. During maximal aerobic exercise, approximately 80-85% of cardiac output is directed to working skeletal muscles compared to 15-20% at rest. In the working muscles, local vasodilation is mediated by metabolic signals. In non-essential organs, vasoconstriction is mediated by the sympathetic nervous system. This dual mechanism accomplishes which physiological objective?

- A. Permanently closing blood vessels to the brain and internal organs during all forms of exercise
- B. Decreasing total cardiac output by 50% to conserve energy for the working muscles
- C. Increasing blood viscosity to force more red blood cells through the contracting muscle tissue
- D. Selectively redistributing cardiac output to prioritize oxygen and nutrient delivery to the most metabolically active tissues while reducing flow to organs with lower immediate metabolic demands

22. A resistance training protocol consisting of 4 sets of 10 at 72% 1RM with 75-second rest periods produces a significant acute growth hormone response. Which specific protocol characteristic is the primary stimulus for this GH elevation?

- A. The heavy absolute load producing maximal motor unit recruitment during each repetition
- B. The metabolic stress from short rest periods — elevated blood lactate, hydrogen ion accumulation, and reduced intracellular pH trigger GH release from the anterior pituitary
- C. The total number of exercises in the program regardless of sets, reps, or rest periods
- D. The time of day the training session is performed relative to the athlete's circadian rhythm

23. Testosterone is the primary natural anabolic hormone promoting muscle protein synthesis. An athlete's blood work shows testosterone at the lower end of the normal range and cortisol at the upper end. The testosterone-to-cortisol ratio is declining over 6 consecutive weeks of monitoring. Performance has stagnated and the athlete reports persistent fatigue. These findings are most consistent with which condition?

- A. Optimal adaptation indicating the athlete is approaching peak performance for competition
- B. Normal hormonal variation that requires no intervention or programming modification
- C. Overreaching or early overtraining — the declining T:C ratio with stagnated performance and persistent fatigue suggests the catabolic environment is outpacing anabolic recovery capacity

D. Excessive protein intake causing hormonal disruption through renal stress

24. Wolff's Law describes bone remodeling in response to mechanical loading. A physician refers a 59-year-old woman with osteopenia for exercise prescription. Based on Wolff's Law, which combination of exercises provides the greatest osteogenic stimulus?

A. Ground-based resistance exercises (squats, deadlifts, weighted lunges) combined with weight-bearing impact activities (walking, stair climbing) — applying compressive and impact forces directly to the axial and appendicular skeleton

B. Aquatic exercise in deep water with complete buoyancy support eliminating gravitational loading

C. Seated upper body machine exercises at very light resistance for 30 repetitions per set

D. Recumbent cycling at extremely low intensity for 20 minutes twice per week

25. An athlete who has been completely inactive for 10 weeks following surgery returns to training. Research on detraining rates indicates the athlete has likely experienced the greatest decline in which physiological quality?

A. Maximal strength, which declines by 60% within the first 48 hours of any inactivity period

B. Bone mineral density, which is completely lost within 5 days of bed rest

C. Flexibility, which is permanently eliminated after 72 hours without stretching regardless of prior training

D. Aerobic capacity ( $VO_{2max}$ ), which shows measurable declines within 1-2 weeks and significant losses by 10 weeks — the most rapidly declining quality during detraining

26. During a plyometric depth jump, the amortization phase must be minimized. Ground contact times should remain below approximately 250 milliseconds to preserve the SSC benefit. An athlete performing depth jumps demonstrates contact times increasing from 180 ms to 380 ms by the seventh repetition with declining rebound height. The strength and conditioning specialist should do which of the following?

A. Increase the box height to 110 cm to force faster transitions under greater eccentric load

- B. Terminate the exercise immediately — the athlete is fatiguing, contact time has more than doubled, and SSC benefit is lost; continuing trains degraded movement patterns with no power benefit
- C. Add weighted vest to increase the eccentric stimulus during subsequent repetitions
- D. Continue to 15 repetitions because plyometric adaptation requires progressive accumulated fatigue

27. At maximum sprint velocity (typically 30-60 meters), ground contact times are approximately 80-100 milliseconds. Research on elite sprinters consistently identifies which ground reaction force component as the primary distinguishing factor between faster and slower runners?

- A. The anteroposterior component pushing the sprinter backward to increase stride length
- B. The mediolateral component providing lateral stability during single-leg support phases
- C. The vertical component — faster sprinters apply greater vertical force relative to body weight during the brief contact phase
- D. All three components contribute equally with no single component distinguishing faster sprinters

28. During the acceleration phase of a sprint (first 10-30 meters), the athlete maintains a pronounced forward body lean. This body position is functionally critical because it allows the athlete to direct ground reaction forces in which direction?

- A. Primarily horizontally backward against the ground, producing the forward-directed reaction force needed to overcome inertia and build forward momentum from a stationary start
- B. Vertically upward to maximize flight time between each stride during early acceleration
- C. Mediolaterally to establish balance before reaching top speed at the 30-meter mark
- D. In no specific direction because body lean has zero effect on force direction during sprinting

29. A trained endurance cyclist has a lactate threshold at 80% of  $\text{VO}_2\text{max}$ , while an untrained recreational rider has a threshold at 50% of  $\text{VO}_2\text{max}$ . The trained cyclist's higher threshold reflects which combination of physiological adaptations?

- A. Decreased mitochondrial density and reduced oxidative enzyme activity in the trained muscles

- B. Complete elimination of all Type II fibers through chronic endurance training
- C. Reduced capillary density and impaired oxygen extraction at the tissue level
- D. Increased mitochondrial density, enhanced oxidative enzyme activity, greater capillary networks, and improved fat oxidation — all reducing the muscle's reliance on anaerobic glycolysis at any given workload

30. An athlete performs a countermovement jump (CMJ) achieving 67 cm and a static squat jump (SJ) achieving 55 cm. The 12 cm difference between these two jump types represents the contribution of the stretch-shortening cycle to the CMJ. The three recognized mechanisms responsible for this SSC enhancement are which of the following?

- A. Increased aerobic energy, enhanced thermoregulation, and improved blood flow during the countermovement
- B. Stored elastic energy in the musculotendinous unit, the stretch reflex from muscle spindle activation, and increased time for force development as tension builds during the eccentric phase
- C. Phosphocreatine super-compensation, glycogen loading, and enhanced fat oxidation during the countermovement
- D. Cardiac output increase, stroke volume elevation, and vasodilation during the countermovement descent

31. Third-class levers — the dominant lever type in the human body — have the effort (muscle insertion) positioned between the fulcrum (joint) and the resistance (external load). The effort arm is shorter than the resistance arm. This arrangement has which functional consequence?

- A. Force amplification allowing the muscle to produce less force than the external load at all joint angles
- B. Equal force and speed because effort and resistance arms are always identical in all human joints
- C. Speed and range of motion favored at the distal end of the lever — a small muscle shortening produces a large fast movement at the hand or foot, but the muscle must produce force many times greater than the external load
- D. Zero mechanical advantage or disadvantage with no functional consequence for movement

32. The SAID principle (Specific Adaptations to Imposed Demands) predicts that the body adapts specifically to the training stimulus applied. A strength and conditioning specialist designs a program for a competitive sprinter consisting exclusively of slow, steady-state jogging at 55% of maximum heart rate with no resistance training, plyometrics, or sprint work. This program violates SAID because it fails to develop which sport-specific demands?

- A. Explosive starting power, maximal sprint velocity, rapid rate of force development, and anaerobic energy system capacity — the specific qualities that determine 100-meter sprint performance
- B. Only slow aerobic jogging is required for sprint performance at all competitive levels
- C. The SAID principle does not apply to track and field events under any circumstance
- D. Only flexibility is relevant to sprinting because stride length determines performance exclusively

33. A strength and conditioning specialist calculates that an athlete holds a 8 kg dumbbell at arm's length with the arm extended horizontally at 90 degrees of shoulder abduction. The distance from the shoulder joint to the dumbbell's center of mass is 0.62 meters. The torque about the shoulder joint is which of the following?

- A. Approximately 8 N·m using only the mass without conversion to Newtons or applying the moment arm
- B. Exactly 0 N·m because torque is not generated when the arm is at 90 degrees
- C. Approximately 200 N·m regardless of the dumbbell weight, distance, or joint angle
- D. Approximately 48.7 N·m — calculated as  $(8 \text{ kg} \times 9.81 \text{ m/s}^2) \times 0.62 \text{ m} = 78.48 \text{ N} \times 0.62 \text{ m} = 48.7 \text{ N}\cdot\text{m}$

34. The force-velocity relationship during eccentric muscle actions differs fundamentally from the concentric relationship. During eccentric actions, force production increases slightly with increasing velocity of lengthening up to a plateau. This eccentric force advantage (approximately 20-60% above maximal isometric force) has which practical training application?

- A. Athletes should never perform eccentric training because the excessive forces always cause injury
- B. Athletes can safely lower loads heavier than their concentric 1RM — this forms the basis for supramaximal eccentric training that provides a novel overload stimulus for strength and connective tissue adaptation

- C. Eccentric and concentric force production are identical at every contraction velocity
- D. Eccentric actions produce zero force because the muscle is only passively stretched

35. Connective tissue structures (tendons, ligaments) adapt to resistance training more slowly than muscle tissue due to lower metabolic activity and blood supply. This differential adaptation rate creates which practical concern for the strength and conditioning specialist?

- A. Connective tissue never adapts to any form of training under any loading condition
- B. Muscle tissue always adapts more slowly than tendons requiring longer muscle recovery
- C. Rapid muscular strength gains can outpace connective tissue strengthening, creating a window of increased tendon and ligament injury risk that requires gradual progressive overload and adequate recovery
- D. Connective tissue adaptation is entirely irrelevant to injury risk under all training conditions

36. Growth hormone (GH) released from the anterior pituitary stimulates the production of insulin-like growth factor-1 (IGF-1) both systemically from the liver and locally within skeletal muscle. The locally produced variant — mechano-growth factor (MGF) — activates satellite cells and stimulates protein synthesis through which intracellular signaling pathway?

- A. The mTOR pathway — the central intracellular regulator of muscle protein synthesis that integrates signals from mechanical loading, amino acid availability, and hormonal stimulation to determine the rate of new protein production
- B. The beta-oxidation pathway that converts fatty acids into amino acid building blocks
- C. The glycolytic pathway that uses lactate as a direct stimulus for protein chain assembly
- D. The cortisol amplification pathway that increases catabolic hormone activity in the muscle cell

37. An exercise physiologist monitors substrate utilization during progressive cycling using RER. At 30%  $VO_{2max}$ , RER is 0.75. At 55%  $VO_{2max}$ , RER rises to 0.85. At 80%  $VO_{2max}$ , RER reaches 0.98. At 95%  $VO_{2max}$ , RER exceeds 1.10. The progressive increase from 0.75 to 0.98 describes which metabolic concept?

- A. A constant metabolic rate with no change in fuel utilization at any exercise intensity
- B. A progressive decrease in all metabolic activity as exercise intensity increases above rest
- C. A shift toward exclusive protein catabolism at each increasing intensity stage
- D. The crossover concept — a progressive shift from predominantly fat oxidation (RER closer to 0.70) to predominantly carbohydrate oxidation (RER closer to 1.00) as exercise intensity increases

38. The Cori cycle recycles lactate into usable glucose through a pathway involving the liver. Lactate produced by working muscles is transported through the blood to the liver, converted to glucose via gluconeogenesis, and released back into the blood for use by the muscles and brain. This metabolic recycling pathway is particularly important because it accomplishes which function?

- A. Permanently removing lactate from the body as a toxic waste product with no metabolic value
- B. Helping maintain blood glucose levels during sustained exercise by recycling lactate into usable glucose — particularly critical for the glucose-obligate brain and for working muscles as glycogen depletes
- C. Converting lactate into fatty acids for long-term storage in adipose tissue during exercise
- D. Transforming lactate into essential amino acids for immediate protein synthesis

39. A strength and conditioning specialist programs conditioning for wrestlers whose matches consist of three 2-minute periods of sustained high-intensity grappling. The dominant energy system for each 2-minute period and the appropriate conditioning protocol are which of the following?

- A. The phosphagen system trained with 5-second efforts and 5-minute rest between intervals
- B. The oxidative system trained with 30-minute continuous moderate-intensity running
- C. The glycolytic system — 2-minute sustained high-intensity efforts fall within the glycolytic-dominant range; conditioning should use intervals of similar duration and intensity with appropriate rest
- D. No energy system is dominant because wrestling relies exclusively on technique

40. Cortisol is a glucocorticoid hormone released from the adrenal cortex in response to physical and psychological stress. Its acute metabolic actions include stimulating protein degradation and gluconeogenesis. These catabolic functions serve which physiological purpose during sustained exercise?

- A. Mobilizing amino acid substrates from muscle protein for glucose production in the liver, providing glucose to the brain and other glucose-dependent tissues during periods of metabolic stress
- B. Directly stimulating muscle protein synthesis through the mTOR signaling pathway
- C. Enhancing glycogen synthesis by activating glycogen synthase enzyme in skeletal muscle
- D. Suppressing all lipolysis to prevent fat mobilization during exercise at any intensity

41. An athlete's hormonal profile after 16 weeks of progressive resistance training shows stable resting testosterone, decreased resting cortisol, and an improved testosterone-to-cortisol ratio. Performance testing shows continued gains and the athlete reports sleeping 8-9 hours nightly with full recovery between sessions. This combined profile indicates which training status?

- A. Advanced overtraining syndrome requiring immediate cessation of all training and medical referral
- B. Hormonal dysfunction from an underlying medical condition unrelated to the training program
- C. The data provide no meaningful information about the athlete's adaptive status or training response
- D. Successful positive adaptation — the favorable T:C ratio, continued performance gains, and subjective recovery confirm the program is producing the intended anabolic-catabolic balance

42. Chronic heavy resistance training increases androgen receptor density in skeletal muscle tissue. This adaptation means that the muscle becomes more sensitive to circulating testosterone. The practical significance for the strength and conditioning specialist is which of the following?

- A. Receptor density changes have absolutely no effect on the muscle's response to hormones
- B. Enhanced receptor density amplifies the anabolic signal at the tissue level, potentially increasing the hypertrophic and strength response to training even without changes in basal circulating testosterone concentrations
- C. The adaptation eliminates the need for adequate sleep, nutrition, and recovery between sessions
- D. Receptor density changes reverse within 24 hours of any training cessation

43. The second-class lever system in the human body is exemplified by the standing calf raise. The fulcrum is at the metatarsophalangeal joint, the resistance (body weight) acts through the ankle, and the effort (gastrocnemius/soleus) acts at the calcaneus. This lever arrangement provides which mechanical advantage?

- A. Speed and range of motion at the expense of force because the effort arm is shorter than the resistance arm
- B. No mechanical advantage because second-class levers have a mechanical advantage of exactly zero
- C. Force production — the effort arm is longer than the resistance arm, creating a mechanical advantage greater than one; the muscle can produce movement against greater resistance than in a third-class arrangement
- D. Equal emphasis on force and speed because the effort and resistance arms are always identical

44. An athlete's testosterone-to-cortisol ratio has been monitored weekly for 8 weeks. The ratio has progressively declined alongside declining 1RM values, increased resting heart rate, persistent insomnia, and reported loss of motivation. Blood work confirms suppressed testosterone and elevated cortisol. The most appropriate immediate intervention is which of the following?

- A. Significantly reducing training volume and intensity, implementing a structured recovery phase, and referring the athlete for medical evaluation — this presentation is consistent with overtraining syndrome requiring aggressive intervention
- B. Doubling the training volume and intensity to force the body through the plateau
- C. Adding a second daily training session to provide additional adaptive stimulus
- D. Maintaining the current program unchanged because all symptoms resolve spontaneously

45. The "muscle memory" phenomenon — where previously trained individuals regain fitness faster than those who have never trained — is explained by which cellular mechanism?

- A. Permanently elevated creatine kinase enzyme levels that persist for years after training cessation
- B. Increased circulating testosterone that remains elevated indefinitely after any training exposure
- C. Residual glycogen stores that remain in muscle fibers for decades after training cessation

D. Retained myonuclei from prior hypertrophic training — satellite cells donate nuclei during hypertrophy that persist even during detraining-induced atrophy, accelerating the protein synthetic response when training resumes

46. A female collegiate distance runner presents with a BMI of 17.8, secondary amenorrhea for 9 months, estimated daily intake of 1,150 calories despite 2.5 hours of daily training, and DEXA-confirmed decreased lumbar bone mineral density. She has suffered two metatarsal stress fractures in the past year. This presentation is most consistent with which condition?

- A. Iron deficiency anemia from inadequate dietary heme iron during high-volume training
- B. Relative Energy Deficiency in Sport (RED-S) — the interrelationship between chronic low energy availability, menstrual dysfunction, and decreased bone mineral density with associated stress fracture risk
- C. Normal physiological adaptation to high-volume endurance training requiring no medical intervention
- D. Vitamin D toxicity from excessive supplementation causing paradoxical bone demineralization

47. Insulin produced by the pancreatic beta cells plays a primarily metabolic role in blood glucose regulation. In the post-exercise recovery context, insulin's most relevant anabolic function is which of the following?

- A. Directly activating satellite cells to initiate hyperplasia and the formation of entirely new fibers
- B. Suppressing all glycogen synthesis to prevent energy storage following intense exercise
- C. Stimulating amino acid uptake into muscle cells and inhibiting protein degradation — creating a favorable anabolic environment that supports recovery when combined with adequate protein and carbohydrate intake
- D. Stimulating cortisol release from the adrenal cortex to enhance the post-exercise catabolic response

48. During moderate-intensity aerobic exercise, systolic blood pressure increases progressively while diastolic pressure remains stable or slightly decreases. The stable diastolic pressure results from which cardiovascular mechanism?

- A. Vasodilation in working muscles reducing total peripheral resistance — this counterbalances the increased cardiac output and prevents diastolic pressure from rising during the relaxation phase of the cardiac cycle
- B. Vasoconstriction in all vascular beds simultaneously increasing peripheral resistance
- C. Decreased cardiac output during the diastolic phase of each heartbeat
- D. Increased blood viscosity maintaining constant pressure regardless of cardiac cycle phase

49. During heavy resistance exercise with the Valsalva maneuver, blood pressure can spike to values exceeding 400/300 mmHg. This acute response is generally tolerated by healthy trained athletes but poses serious risk for which population?

- A. Professional powerlifters competing in sanctioned meets with medical personnel present
- B. Collegiate athletes with current medical clearance performing supervised compound lifts
- C. Military personnel performing occupational fitness assessments under qualified supervision
- D. Individuals with uncontrolled hypertension or cardiovascular disease — the extreme transient pressure spikes may exceed the structural limits of compromised blood vessels or the functional capacity of a damaged heart

50. A strength and conditioning specialist is evaluating two vertical jump performances on a force plate. Both athletes weigh 85 kg. Athlete A produces 2,900 N of peak GRF in 150 milliseconds. Athlete B produces 2,900 N in 280 milliseconds. Despite identical peak force, Athlete A achieves a significantly higher jump. The physical quality explaining this difference is which of the following?

- A. Greater absolute strength in Athlete A that was not captured by the identical force measurements
- B. Superior rate of force development in Athlete A — reaching the same peak force in nearly half the time produces greater impulse during the limited ground contact, resulting in higher takeoff velocity and jump height
- C. Greater aerobic capacity in Athlete A providing oxidative energy during the 0.3-second jump
- D. Superior flexibility in Athlete A producing a deeper countermovement that extends total contact time

51. A strength and conditioning specialist wants to develop an athlete's rate of force development (RFD) — the speed at which force rises from baseline to peak during a rapid contraction. Which training modality most directly develops this quality?

- A. Slow, controlled resistance training at 40% 1RM with a 6-second concentric tempo
- B. Prolonged low-intensity aerobic exercise at 45%  $\text{VO}_2\text{max}$  for cardiovascular conditioning
- C. Explosive training including Olympic lifts, plyometrics, and ballistic exercises that require maximal-velocity force production — directly training the neuromuscular system to produce force rapidly
- D. Sustained isometric holds at 20% of maximal voluntary contraction for 90-second durations

52. The sliding filament theory explains muscle contraction through the sliding of thin (actin) filaments over thick (myosin) filaments. During this process, the sarcomere shortens but the individual filaments do not change length. The A-band — representing the full length of the myosin filaments — remains constant in width because of which reason?

- A. The A-band narrows proportionally with sarcomere shortening because myosin filaments compress
- B. The A-band disappears completely during maximal contraction as actin filaments overlap
- C. The A-band does not exist during active contraction and only appears at rest
- D. The myosin (thick) filaments themselves do not shorten during contraction — only the relative position of actin over myosin changes; therefore the A-band width remains constant

### **SPORT PSYCHOLOGY (Questions 53–75)**

53. An elite gymnast reports two categories of pre-competition symptoms: racing thoughts about scoring, worry about falling during the routine, and fear of disappointing the coaching staff (Group 1), along with elevated heart rate, sweaty palms, and tight shoulders (Group 2). Group 1 symptoms are classified as cognitive anxiety. Which intervention most directly addresses these cognitive symptoms?

- A. Progressive muscle relaxation targeting the physical tension in the shoulders and neck
- B. Biofeedback training using heart rate monitors to reduce the elevated cardiovascular activation

- C. Ice bath immersion before the event to lower core temperature and reduce physical symptoms
- D. Thought stopping with instructional self-talk replacement — interrupting negative thoughts and substituting task-relevant cues such as "tight core" and "stick the landing"

54. Bandura's self-efficacy theory identifies four sources: past performance accomplishment, vicarious experience, verbal persuasion, and physiological state interpretation. An athlete who has never attempted a 200 kg squat watches a training partner of similar build and experience successfully complete the lift. This observation increases the athlete's belief that they can also achieve 200 kg. Which source is responsible?

- A. Past performance accomplishment based on personal mastery of the specific task
- B. Vicarious experience — observing someone of comparable capability succeed provides evidence that the task is achievable
- C. Verbal persuasion from the coach encouraging the attempt before it occurs
- D. Physiological state interpretation based on the absence of pre-lift anxiety symptoms

55. The inverted-U hypothesis predicts that optimal arousal varies with task demands. A sniper on a military marksmanship team requires steady hands, controlled breathing, and precise trigger control for a long-range precision shot. Based on the inverted-U prediction for this type of fine motor precision task, the optimal arousal level should be which of the following?

- A. Very high arousal to maximize all muscle activation for steadying the rifle under pressure
- B. High arousal identical to the optimal level for a maximal-effort football tackle or block
- C. Relatively low arousal — excessive activation causes tremor, attentional narrowing, and impaired fine motor control that degrade the precision required for long-range accuracy
- D. Arousal level is completely irrelevant because it has no measurable effect on precision tasks

56. A strength and conditioning specialist designs a 16-week program for an Olympic weightlifter. According to goal-setting research, which goal-setting approach provides the most effective framework for sustained daily adherence and long-term competitive success?

- A. Only a single outcome goal ("Win nationals") with no intermediate targets or daily behavioral goals
- B. Only process goals without any long-term direction or measurable performance benchmarks
- C. No goals of any type because goal-setting has been proven to decrease athletic motivation
- D. Goal setting should not be used for Olympic sports because international competition is too unpredictable

57. An athlete performs well in practice consistently but underperforms in every major competition. The athlete reports intense worry, fear of failure, and negative self-talk such as "Everyone is watching me fail" during competitions. This pattern is most consistent with which phenomenon?

- A. Social facilitation where the presence of spectators always enhances competitive performance
- B. Optimal arousal producing the athlete's best possible performance in competitive settings
- C. A permanent personality disorder preventing competitive success regardless of intervention
- D. Choking under pressure — excessive cognitive anxiety in high-stakes situations disrupts the automatic execution of well-learned motor skills

58. A sport psychologist recommends diaphragmatic breathing and progressive muscle relaxation for an athlete reporting pre-competition muscle tension, elevated resting heart rate, and rapid shallow breathing. These techniques specifically address which anxiety component?

- A. Cognitive anxiety characterized by negative thought patterns, worry, and fear of failure
- B. Somatic anxiety — the physiological symptoms including muscle tension, cardiovascular activation, and respiratory changes that are directly targeted by physical relaxation techniques
- C. Trait anxiety that is a permanent personality disposition unresponsive to any psychological intervention
- D. Social anxiety exclusively involving fear of media criticism and spectator judgment

59. Mental imagery research demonstrates that the most effective imagery engages multiple sensory modalities simultaneously. A soccer player preparing for a penalty kick should construct their imagery using which combination?

- A. Only visual imagery of the ball entering the goal with all other senses suppressed
- B. Only kinesthetic feeling of the kicking motion without visual or emotional engagement
- C. Visual (seeing the ball path), kinesthetic (feeling the leg swing and foot contact), auditory (hearing the ball strike the net), and emotional (experiencing the confidence of scoring) simultaneously
- D. Only the emotional feeling of anxiety to prepare for worst-case failure scenarios

60. In Fitts and Posner's three-stage model of motor learning, an athlete who has been practicing the power snatch for 3 weeks demonstrates highly variable performance, large frequent errors, and heavy reliance on the coach's verbal instructions and demonstrations. This athlete is in which learning stage?

- A. The autonomous stage where the movement is fully automated and requires zero conscious attention
- B. The associative stage where errors are smaller and the athlete is beginning to self-correct
- C. The preparatory stage where no physical practice has yet occurred
- D. Negative transfer where a prior skill is interfering with the current one

61. The contextual interference effect demonstrates that random practice produces slower initial improvement but better long-term retention compared to blocked practice. A training session intermixing three exercises in random order (ABCBACBCA) rather than completing all sets of each before moving to the next (AAABBBCCC) produces which long-term learning outcome?

- A. Faster initial improvement and superior long-term retention simultaneously in every scenario
- B. Identical outcomes to blocked practice because practice structure has no learning effect
- C. Faster initial improvement with inferior long-term retention identical to blocked practice results
- D. Slower initial improvement but significantly better long-term retention and transfer — the constant task-switching forces deeper cognitive processing that builds more robust motor program representations

62. The guidance hypothesis regarding feedback frequency states that providing extrinsic feedback after every single repetition during skill acquisition produces which long-term consequence?

- A. Optimal permanent retention because maximum feedback always produces maximum learning
- B. Impaired long-term learning because the athlete develops dependency on external correction rather than developing independent internal error-detection capabilities
- C. No measurable effect because feedback frequency has no relationship to skill acquisition
- D. Accelerated mastery that persists indefinitely without any negative side effects

63. A coach tells an athlete: "Your hips rose too fast and your chest dropped during the deadlift pull." This feedback describes the quality of the movement technique — how the lift was executed rather than the outcome. This type of feedback is classified as which of the following?

- A. Knowledge of results (KR) providing information about the outcome of the deadlift attempt
- B. Intrinsic feedback perceived through the athlete's own proprioceptive sensory systems
- C. Knowledge of performance (KP) — information about the movement pattern and execution quality itself
- D. Motivational feedback designed exclusively to increase effort during subsequent repetitions

64. Distributed practice (shorter sessions with rest intervals) produces superior long-term motor learning compared to massed practice. The primary mechanism explaining this advantage is which of the following?

- A. Memory consolidation during rest intervals — the neurological process of stabilizing and transferring motor memories from short-term to long-term storage, producing more durable representations
- B. Distributed practice eliminates all performance errors during acquisition permanently
- C. Massed practice produces zero learning under any circumstances or conditions regardless of skill
- D. Rest intervals allow complete glycogen resynthesis that improves motor cortex function

65. An athlete who has been progressively withdrawn over several weeks, reports persistent loss of motivation, expresses feeling "trapped" in their sport with no enjoyment, and demonstrates emotional exhaustion during training is most likely experiencing which condition?

- A. Optimal psychological readiness indicating the athlete is peaking for competition
- B. Normal day-to-day mood fluctuation that always resolves spontaneously within hours
- C. Acute pre-competition anxiety that will disappear immediately after the next competitive event
- D. Athletic burnout — characterized by emotional exhaustion, depersonalization (cynicism toward the sport), and reduced sense of personal accomplishment

66. A 15-year-old high school athlete has become increasingly isolated, reports persistent feelings of worthlessness, has lost interest in activities previously enjoyed, and expresses hopelessness about the future. The strength and conditioning specialist should respond by doing which of the following?

- A. Designing a more intense training program to rebuild confidence through physical success
- B. Recognizing these as potential warning signs of clinical depression and recommending that parents seek evaluation from a qualified mental health professional
- C. Increasing the competitive schedule to provide more opportunities for success and recognition
- D. Ignoring the behavior because all mood changes in adolescents resolve naturally without intervention

67. A collegiate wrestler displays extreme pre-weigh-in weight manipulation, avoidance of team meals, excessive exercise beyond the prescribed training plan, and preoccupation with body weight. The CSCS-credentialed professional should respond by doing which of the following?

- A. Prescribing a detailed meal plan to correct the wrestler's perceived nutritional deficiencies
- B. Conducting more frequent body composition testing to monitor weight fluctuations more closely
- C. Referring the athlete to a qualified healthcare professional for evaluation and treatment — diagnosing and treating eating disorders is outside the CSCS scope of practice
- D. Ignoring the warning signs because weight manipulation is an accepted tradition in wrestling

68. Self-determination theory identifies autonomy, competence, and relatedness as three basic psychological needs supporting intrinsic motivation. A training environment that systematically removes all athlete input, provides no positive feedback on improvement, and isolates underperforming athletes would most directly undermine which motivational outcome?

- A. Intrinsic motivation — all three basic psychological needs (autonomy, competence, relatedness) are simultaneously violated, directly undermining the most sustainable form of motivation
- B. Exclusively extrinsic motivation, which would actually be enhanced by the authoritarian environment
- C. Only relatedness with no effect on autonomy or competence perceptions whatsoever
- D. No motivational outcome because self-determination theory does not apply to athletic contexts

69. RED-S (Relative Energy Deficiency in Sport) affects both male and female athletes with chronic low energy availability. In male athletes specifically, the documented consequences include which combination?

- A. Enhanced performance from the metabolic efficiency gained through chronic energy restriction
- B. Increased testosterone production as an adaptive hormonal response to the caloric deficit
- C. No health consequences because RED-S affects exclusively female athletes
- D. Suppressed testosterone, decreased bone mineral density, impaired immune function, and declining athletic performance

70. An athlete returning from ACL reconstruction demonstrates significant fear of re-injury during cutting and pivoting drills despite full physical clearance from the surgical team and physical therapist. The strength and conditioning specialist's most appropriate comprehensive response includes which of the following?

- A. Immediately returning the athlete to full-contact competition to force them past the fear
- B. Gradually reintroducing sport-specific movements at progressive intensities while facilitating referral to a sport psychologist for evidence-based treatment of the re-injury fear
- C. Permanently eliminating all cutting and pivoting from the athlete's training program
- D. Telling the athlete that psychological concerns are irrelevant to the return-to-play process

71. Research on the psychological impact of athletic injury consistently demonstrates that athletes experiencing significant psychological distress during rehabilitation (fear of re-injury, frustration, depression, social isolation from the team) have which rehabilitation outcome?

- A. Identical outcomes to psychologically well-adjusted athletes because psychological state has no effect
- B. Faster recovery because distress motivates more intense rehabilitation effort
- C. Longer recovery times and higher re-injury rates — psychological distress significantly impairs rehabilitation outcomes and return-to-play success
- D. Improved mental toughness that enhances all future competitive performance

72. Motor program theory distinguishes between invariant features (relative timing, relative force proportions, spatial pattern) and variable parameters (absolute speed, absolute force, specific muscles) of a generalized motor program. When a baseball pitcher throws a fastball then a changeup using the same arm action, which parameter is adjusted while the invariant features remain constant?

- A. The overall speed and absolute force of the execution — these variable parameters are adjusted for each pitch type while the invariant features (relative timing, relative force proportions, fundamental spatial pattern) remain constant
- B. The relative timing and sequencing of all muscle activations, which are completely restructured for each pitch
- C. The fundamental spatial pattern of the throwing trajectory, which changes for each pitch type
- D. Nothing changes because the GMP is completely fixed and cannot be modified for different situations

73. An athlete who successfully completes a 190 kg back squat for the first time reports significantly increased confidence about attempting 195 kg at the next session. According to Bandura's self-efficacy theory, this confidence increase is primarily driven by which source?

- A. Vicarious experience from watching a training partner complete 195 kg before the athlete's attempt
- B. Verbal persuasion from the coach predicting success at 195 kg after the athlete's 190 kg lift
- C. Physiological state interpretation based on the absence of pre-lift anxiety symptoms

D. Past performance accomplishment — the direct mastery experience of the 190 kg squat, the most powerful source of self-efficacy

74. In Nideffer's attentional focus model, a basketball point guard scanning the entire defensive formation to identify coverage gaps and open receivers before initiating a fast break is using which attentional focus type?

A. Narrow-internal focus directed at body sensations during the dribbling motion

B. Broad-external focus — scanning a wide visual field to perceive multiple defenders, teammates, and spatial relationships simultaneously for tactical decision-making

C. Narrow-external focus locked exclusively on a single defender's jersey number

D. Broad-internal focus analyzing personal emotional state without environmental awareness

75. Transfer of training describes how practice on one skill affects performance on another. A strength and conditioning specialist prescribes front squats to improve the athlete's power clean receiving position. This exercise selection is designed to exploit which type of transfer?

A. Negative transfer where the front squat impairs the power clean rack position through conflicting patterns

B. Zero transfer because no exercise can influence the learning of any other exercise

C. Positive transfer — the front squat develops the upright torso, high-elbow rack position, and receiving posture that directly transfer to the power clean catch position

D. Random transfer that cannot be predicted from the similarity between the two movements

### **NUTRITION (Questions 76–95)**

76. A 105 kg strength athlete requires daily protein at the upper end of evidence-based recommendations to support a heavy resistance training phase. At 2.2 g/kg/day, the daily protein target is which of the following?

- A. 231 grams per day calculated as  $105 \text{ kg} \times 2.2 \text{ g/kg/day}$  — supporting elevated protein synthesis, tissue repair, and anti-catabolic demands
- B. 84 grams per day based on the general population RDA of  $0.8 \text{ g/kg/day}$
- C. 525 grams per day based on an exaggerated  $5.0 \text{ g/kg}$  recommendation
- D. 42 grams per day consumed exclusively in a single pre-sleep meal

77. Post-exercise protein intake of 20-40 grams of high-quality protein maximizes the acute muscle protein synthetic response. The branched-chain amino acid identified as the primary trigger for mTOR pathway activation is which of the following?

- A. Glutamine, the most abundant amino acid in the body with limited evidence for MPS triggering
- B. Glycine, the smallest amino acid with the fastest intestinal absorption rate
- C. Alanine, the primary gluconeogenic amino acid used for hepatic glucose production
- D. Leucine — the key trigger for mTOR activation; approximately 2-3 grams per meal ensures optimal stimulation of the protein synthetic machinery

78. An athlete following a very low-fat diet (less than 15% of total calories) for 5 months reports declining energy, poor recovery, and suppressed testosterone on blood work. The most likely nutritional cause is which of the following?

- A. Excessive protein intake causing renal overload and secondary hormonal disruption
- B. Inadequate dietary fat impairing steroid hormone production (cholesterol is the testosterone precursor) and reducing absorption of fat-soluble vitamins (A, D, E, K)
- C. Excessive carbohydrate causing permanent insulin resistance and hormonal dysfunction
- D. Inadequate water intake causing chronic dehydration that mimics hormonal suppression

79. During a 5-hour ultramarathon on a warm day, an athlete consumes only plain water at 2.5 liters per hour without any sodium-containing fluids. After the race, the athlete becomes confused, disoriented, and nauseated. Emergency medical personnel diagnose exercise-associated hyponatremia. This condition resulted from which mechanism?

- A. Excessive blood sodium concentration from sodium retention during prolonged running
- B. Metabolic alkalosis from the elevated pH of the plain water consumed
- C. Dilution of blood sodium concentration by massive plain water intake relative to sodium losses through sweat, reducing serum sodium below safe levels
- D. Rhabdomyolysis from mechanical skeletal muscle damage during the 5-hour run

80. Creatine monohydrate supplementation increases intramuscular phosphocreatine stores. The standard loading protocol (20 g/day for 5-7 days) achieves rapid saturation. An athlete who prefers the maintenance-only approach (3-5 g/day without loading) will achieve full saturation in approximately how long?

- A. Approximately 28 days of consistent daily supplementation — equally effective as loading for reaching the same saturated endpoint, but requiring 4 weeks instead of 1 week
- B. 24-48 hours of supplementation at the maintenance dose
- C. Full saturation can never be achieved without the loading phase
- D. 6-12 months regardless of daily dose consumed

81. Caffeine enhances exercise performance at ergogenic doses of 3-6 mg/kg consumed 30-60 minutes before exercise. A 70 kg athlete wanting the lower end of the effective dose should consume approximately which amount?

- A. 700 mg — far exceeding the recommended range and dramatically increasing side effect risk
- B. 10 mg — far below the threshold for any measurable physiological or performance effect
- C. Caffeine has no ergogenic properties and should never be consumed before exercise
- D. 210 mg ( $70 \times 3 = 210$  mg), representing the lower end of the effective ergogenic dose range

82. Beta-alanine supplementation increases intramuscular carnosine, which buffers hydrogen ions during high-intensity exercise. This buffering effect is most beneficial for performance in activities lasting which duration?

- A. Less than 5 seconds where phosphocreatine is the exclusive ATP source
- B. 1-4 minutes where glycolytic hydrogen ion accumulation is the primary performance limiter
- C. Longer than 60 minutes where fat oxidation is the predominant energy pathway
- D. During complete rest when no metabolic byproducts are being produced

83. An athlete subject to WADA anti-doping regulations wants to minimize the risk of inadvertent positive drug tests from supplement contamination. The recommended third-party certification to look for on product labels is which of the following?

- A. USDA Organic, which guarantees the complete absence of all banned substances
- B. FDA pharmaceutical approval, which is mandatory for all dietary supplements sold commercially
- C. NSF Certified for Sport or Informed Sport — independent programs that test for banned substances, verify label accuracy, and screen for undeclared contaminants
- D. ISO 9001 manufacturing certification, which verifies banned substance screening protocols

84. For an athlete in caloric deficit attempting to lose body fat while preserving lean muscle mass, the evidence supports protein intake at which level?

- A. 2.0-2.4 g/kg/day — at the upper end of recommendations to maximize lean mass preservation during energy restriction, combined with maintained resistance training
- B. The general population RDA of 0.8 g/kg/day, sufficient for all populations during restriction
- C. Less than 0.5 g/kg/day to aggressively minimize total caloric intake regardless of lean mass
- D. No protein because complete elimination accelerates fat loss without affecting muscle tissue

85. Sodium bicarbonate is an extracellular buffer that enhances performance during high-intensity glycolytic exercise at doses of 0.2-0.3 g/kg consumed 60-90 minutes before exercise. The mechanism of action involves which physiological process?

- A. Directly increasing intramuscular phosphocreatine stores by 50% above normal baseline
- B. Stimulating muscle protein synthesis equivalent to 40 grams of whey protein isolate
- C. Permanently increasing  $\text{VO}_2\text{max}$  by enhancing mitochondrial oxygen utilization capacity
- D. Increasing the blood pH gradient between the muscle and blood, facilitating greater efflux of hydrogen ions from working muscles and delaying acidosis-related fatigue

86. An endurance athlete training at high volume requires carbohydrate at the upper end of recommendations. For a 75 kg athlete at 10 g/kg/day, the daily carbohydrate target is which of the following?

- A. 75 grams per day based on a very low carbohydrate approach of 1 g/kg/day
- B. 750 grams per day calculated as  $75 \text{ kg} \times 10 \text{ g/kg/day}$  — supporting extreme glycogen demands
- C. 375 grams per day based on a moderate recommendation of 5 g/kg/day
- D. 1,500 grams per day calculated by doubling the upper recommendation

87. Vitamin D deficiency is prevalent among athletes training indoors or living at northern latitudes. Documented consequences include which of the following?

- A. Excessive uncontrollable muscle hypertrophy exceeding all desired training adaptations
- B. Enhanced athletic performance from metabolic efficiency of vitamin D-depleted tissues
- C. Impaired muscle function, compromised immune competence, and elevated risk of stress fractures with decreased bone mineral density
- D. No consequences because vitamin D has no role in muscle, bone, or immune function

88. Iron deficiency is the most common nutritional deficiency worldwide and is particularly prevalent among female athletes and endurance athletes. Consuming vitamin C alongside non-heme iron sources enhances absorption through which mechanism?

- A. Vitamin C converts ferric iron ( $\text{Fe}^{3+}$ ) to the more bioavailable ferrous form ( $\text{Fe}^{2+}$ ), enhancing intestinal absorption of non-heme iron from plant-based and fortified sources
- B. Vitamin C inhibits all iron absorption as a protective mechanism against iron overload
- C. Vitamin C has no interaction with iron metabolism under any dietary circumstance
- D. Vitamin C enhances heme iron absorption exclusively while blocking non-heme iron

89. When two training sessions are scheduled within 8 hours, post-exercise carbohydrate intake within 30 minutes of the first session is critical for rapid glycogen replenishment. The recommended intake during this window is which of the following?

- A. No carbohydrate for 12 hours to promote fat adaptation before the second session
- B. 0.1 g/kg — a minimal amount to prevent any meaningful insulin response
- C. Only protein with zero carbohydrate because glycogen synthesis is independent of carbohydrate
- D. 1.0-1.5 g/kg of carbohydrate to maximize glycogen synthase activity during the period of highest enzyme sensitivity

90. A plant-based athlete asks the strength and conditioning specialist how to ensure adequate essential amino acid intake from a diet excluding all animal products. The recommended strategy is which of the following?

- A. Plant-based diets cannot provide adequate amino acids for athletes under any strategy
- B. Consuming a variety of complementary plant protein sources throughout the day ensures all essential amino acids are provided — grains compensate for legumes' limitations and vice versa
- C. Only soy protein is acceptable because all other plant sources contain zero essential amino acids
- D. Supplementation with 100 grams of isolated BCAAs daily is required for all plant-based athletes

91. Consuming 30-40 grams of casein protein before sleep supports overnight recovery through which mechanism?

- A. Immediate gastric emptying identical to whey with no difference in digestion or absorption rate
- B. Casein is entirely wasted because protein consumed before sleep is completely excreted unabsorbed
- C. Casein forms a gel in the stomach slowing digestion, providing sustained amino acid delivery throughout the overnight fasting period (7-9 hours) to support muscle protein synthesis during sleep
- D. Complete suppression of all catabolic hormones for 48 hours following bedtime consumption

92. High-glycemic index (GI) foods produce rapid blood glucose and insulin responses after ingestion. These foods are most appropriately consumed at which time relative to exercise?

- A. During and immediately after exercise when rapid glucose delivery and glycogen replenishment are the priorities — the fast absorption rate matches the acute metabolic needs of the peri-exercise window
- B. Only at breakfast regardless of training schedule or competition timing
- C. Exclusively before sleep to maximize overnight insulin secretion
- D. High-GI foods should never be consumed by any athlete under any circumstance

93. The evidence base for glutamine supplementation to promote muscle growth in healthy, well-nourished athletes with adequate protein intake is best described as which of the following?

- A. Glutamine has the strongest evidence of any supplement for hypertrophy, surpassing creatine
- B. Glutamine permanently elevates testosterone at all doses in every athletic population
- C. Glutamine is the only supplement universally approved by all international anti-doping agencies
- D. Limited — glutamine has not demonstrated strong evidence for muscle growth in healthy athletes and is not classified among supplements with robust ergogenic evidence

94. Adequate dietary fat intake (20-35% of total calories) is recommended because fat serves which combination of essential physiological functions?

- A. Fat has no physiological function and can be eliminated from any diet without consequence
- B. Steroid hormone production (cholesterol is the testosterone precursor), fat-soluble vitamin absorption (A, D, E, K), cell membrane integrity, and provision of essential fatty acids the body cannot synthesize
- C. Fat is the exclusive fuel for the phosphagen system during maximal sprinting events
- D. Fat directly stimulates Type IIX fiber hyperplasia independent of any training stimulus

95. An athlete competing in a 90-minute team sport with repeated sprints should maintain hydration to prevent body weight loss exceeding 2%. The general fluid intake guideline during competition is which of the following?

- A. No fluid during competition because drinking always impairs athletic performance
- B. A minimum of 4 liters consumed in a single bolus at halftime regardless of thirst or sweat rate
- C. Approximately 200-300 mL every 15-20 minutes, adjusted for individual sweat rate and environmental conditions
- D. Only caffeinated beverages because caffeine simultaneously enhances hydration and performance

## **SECTION 2 — PRACTICAL/APPLIED**

**125 Questions | 2.5 Hours Recommended**

### **EXERCISE TECHNIQUE (Questions 96–140)**

96. Before loading any barbell exercise, a strength and conditioning specialist should assess each novice athlete's movement competency by having them perform which unloaded assessment?

- A. A bodyweight squat to evaluate ankle dorsiflexion, hip flexion, thoracic extension, knee tracking, and spinal neutrality before adding external load
- B. A 1RM back squat at maximum weight to establish baseline strength values

- C. A barbell overhead press at 80% of estimated 1RM to test shoulder stability
- D. A weighted depth jump from a 42-inch box to assess reactive strength and landing mechanics

97. During a barbell back squat, an athlete's heels consistently rise off the floor during the descent. This compensatory pattern most commonly indicates which underlying mobility limitation?

- A. Excessive hip flexion mobility causing the pelvis to tilt beyond normal limits
- B. Superior quadriceps strength overpowering the posterior chain during the descent
- C. Excessive thoracic extension pushing the torso backward during the squat movement
- D. Insufficient ankle dorsiflexion mobility preventing the tibia from translating forward adequately to maintain balance with the heels grounded

98. An athlete performing the conventional deadlift is observed with the barbell drifting forward of the shins during the initial pull. This forward drift produces which biomechanical consequence?

- A. Decreased torque demand on the lumbar spine because the bar is further from the body
- B. Increased moment arm on the lumbar spine, dramatically increasing the flexion torque the erector spinae must resist and elevating lumbar injury risk
- C. Improved leverage for the quadriceps during the initial knee extension phase
- D. No biomechanical consequence because bar path does not affect spinal loading

99. A strength and conditioning specialist requires all athletes to use a closed grip (thumbs wrapped) during the barbell bench press. The safety rationale for this requirement is which of the following?

- A. A closed grip activates the pectoralis major more effectively than alternative grip positions
- B. A closed grip is purely a personal preference with no safety implications whatsoever
- C. A closed grip prevents the bar from rolling out of the hands onto the chest, neck, or face — a potentially catastrophic event that can occur with an open (false) grip
- D. A closed grip increases the total range of motion by approximately 4 inches

100. During a standing overhead press, an athlete arches the lower back into extreme hyperextension to compensate for a load exceeding their strict pressing capacity. This compensation creates which safety concern?

- A. Compressive and shear forces on the lumbar spine increasing injury risk, while shifting the exercise toward an incline press pattern and reducing the effective overhead range of motion
- B. Enhanced deltoid activation because the arch improves the pressing angle
- C. Improved spinal stability because lumbar extension is the preferred pressing technique
- D. No safety concern because lumbar position has no effect on injury risk during pressing

101. The NSCA's recommended top-down teaching progression for the power clean begins with which exercise?

- A. The full squat clean from the floor at near-maximal loads to test natural athletic ability
- B. The clean pull from the floor without any catch to develop pulling strength independently
- C. The hang power clean from above the knee at challenging loads for explosive hip extension
- D. The front squat — establishing the front rack receiving position, comfort with the bar on the anterior deltoids, and upright receiving posture before any pulling phases are introduced

102. During the second pull of the power clean, the athlete should drive through explosive triple extension (hips, knees, ankles) while keeping the arms straight. An athlete who prematurely bends the elbows during the second pull commits which error and experiences which consequence?

- A. The preferred technique variation recommended for loads above 60% of 1RM
- B. Pulling with the arms rather than driving through triple extension — reducing the contribution of the powerful hip extensors, limiting bar velocity, and restricting the weight that can be cleaned
- C. The correct arm action for maximizing bar velocity during Olympic lifting at all load ranges
- D. An appropriate modification for athletes with limited shoulder mobility during the pulling phase

103. A strength and conditioning specialist is programming the first plyometric session for collegiate athletes who have completed 12 weeks of resistance training but have no plyometric experience. The appropriate exercise intensity and volume is which of the following?

- A. High-intensity depth jumps from 42-inch boxes at 250 foot contacts per session
- B. Single-leg depth jumps with weighted vests at 200 foot contacts per session
- C. Low-to-moderate intensity exercises (squat jumps, CMJ, box jumps stepping down) at 80-100 foot contacts
- D. Weighted jump squats at 60% 1RM for 300 foot contacts per session

104. When spotting a barbell back squat with a single spotter, the spotter positions behind the athlete and provides assistance at which location?

- A. Near the athlete's torso with arms extending under the armpits to assist upward — never gripping the barbell directly
- B. On the barbell at each end to lift the weight off the athlete's shoulders
- C. On the athlete's hips to push them straight upward during a failed attempt
- D. On the athlete's shoulders to stabilize the upper body throughout all repetitions

105. The Valsalva maneuver — forceful exhalation against a closed glottis creating extreme intra-thoracic and intra-abdominal pressure — is appropriate for which specific population and exercise context?

- A. All populations regardless of cardiovascular status during every exercise at all intensities
- B. Only during very light isolation exercises at 20% of 1RM for muscle toning purposes
- C. Individuals with uncontrolled hypertension performing any type of resistance exercise
- D. Healthy, trained athletes performing heavy compound lifts (near-maximal squats, deadlifts, presses) where maximal intra-abdominal pressure provides essential spinal stabilization

106. An athlete performing barbell bent-over rows rounds the spine significantly while jerking the weight upward with body momentum. The specialist should respond by doing which of the following?

- A. Encouraging the momentum technique because it enables heavier loads for progressive overload
- B. Terminating the set, reducing the load, and cueing rigid spinal neutrality with the pull initiated by deliberate scapular retraction before elbow flexion
- C. Adding more weight because the athlete clearly has untapped capacity for this exercise
- D. Switching permanently to a different exercise because rows cannot be performed safely by anyone

107. A baseball pitcher needs rotational power for throwing and anti-rotation stability for deceleration and spinal protection. Which exercise combination addresses both demands?

- A. Only weighted decline sit-ups because trunk flexion is the exclusive core demand for all pitchers
- B. Only isometric front plank holds for maximum duration targeting endurance as the sole need
- C. Medicine ball rotational throws for explosive power production and Pallof press variations for anti-rotation stability and spinal protection
- D. Heavy Russian twists at maximum velocity as the sole core training exercise needed

108. Anti-extension core exercises (ab wheel rollout, front plank progressions) train the core musculature to resist which specific spinal movement?

- A. Lumbar hyperextension — resisting the tendency for the lumbar spine to arch as gravity or external load pulls it into extension, maintaining spinal neutrality through active anterior core engagement
- B. Trunk rotation in the transverse plane during throwing and striking athletic activities
- C. Lateral trunk flexion in the frontal plane during side-stepping and cutting movements
- D. Trunk flexion in the sagittal plane as occurs during weighted crunches and sit-up exercises

109. During sprint acceleration (first 10-30 meters), running fully upright from the first step produces which performance consequence?

- A. Enhanced acceleration because the upright position maximizes stride frequency from the start
- B. No consequence because body position has absolutely no relationship to acceleration mechanics
- C. Improved top-end speed that fully compensates for any reduction in initial acceleration
- D. Reduced horizontal GRF production, impairing acceleration because the upright position directs forces too vertically rather than horizontally

110. The pro agility shuttle (5-10-5) technically assesses change-of-direction speed rather than true agility because it lacks which component?

- A. A physical deceleration and reacceleration requirement at each turn point
- B. A reactive perceptual-cognitive decision-making component requiring response to unpredictable stimuli — this decision-making element defines true agility and distinguishes it from preplanned COD tests
- C. Multiple directional changes exceeding two within the test
- D. Any timing mechanism to measure the speed of the performance

111. Dynamic stretching before explosive exercise is preferred over static stretching because research demonstrates which finding?

- A. Static stretching permanently destroys muscle fibers preventing all future force production
- B. Dynamic and static stretching produce identical effects on all subsequent performance variables
- C. Dynamic stretching increases ROM while simultaneously activating the neuromuscular system, whereas static stretching before explosive activity acutely reduces force production and power
- D. Dynamic stretching provides no flexibility benefit and serves only as cardiovascular warmup

112. Foam rolling used before training provides which advantage compared to static stretching?

- A. Increased ROM without the acute decrements in force production and power associated with static stretching — preserving neuromuscular readiness for subsequent explosive performance
- B. Foam rolling permanently restructures fascial tissue after one 30-second application
- C. Foam rolling produces identical performance decrements to 60-second static stretching holds
- D. Foam rolling reduces ROM compared to performing no pre-training mobility work

113. A complete warmup before heavy resistance training should progress in which sequence?

- A. Heavy working sets → static stretching → general warmup → cooldown
- B. Static stretching → maximal lifts → dynamic stretching → isolation exercises
- C. No warmup is necessary because resistance training serves as its own preparation
- D. General warmup → dynamic stretching → movement preparation → specific warmup with progressive loading in the session's exercises

114. Chronic cold water immersion after every resistance training session may produce which unintended consequence based on current evidence?

- A. Accelerated hypertrophy beyond what any other recovery modality can achieve
- B. Blunted inflammatory signaling necessary for muscle hypertrophy and strength adaptation — the acute post-training inflammation is part of the adaptive cascade, and chronically suppressing it may impair gains
- C. Enhanced neural adaptation and increased maximal voluntary contraction strength
- D. Improved tendon remodeling and connective tissue strengthening above normal rates

115. The foundational recovery practices — more important than any external modality, device, or technology — are which of the following?

- A. Pneumatic compression boots for 60 minutes after every training session

- B. Cryotherapy chambers at  $-110^{\circ}\text{C}$  twice daily regardless of training content
- C. Adequate sleep of 7-10 hours nightly combined with appropriate post-exercise nutrition (protein for muscle repair, carbohydrate for glycogen replenishment)
- D. Electrical muscle stimulation applied to all major muscle groups for 90 minutes nightly

116. A conditioning program for a basketball team (48-minute games with sprints, jumps, direction changes) should include which comprehensive approach?

- A. A combination of aerobic base training (tempo runs, fartlek), anaerobic interval training (court-length sprints with sport-specific rest), and reactive agility conditioning
- B. Exclusively long-distance running at 60% HRmax five days per week
- C. Only heavy resistance training with no conditioning component of any kind
- D. Only static stretching for 60 minutes per session as the exclusive conditioning method

117. The aerobic system's most important contribution to team sport athletes performing repeated high-intensity sprints is which of the following?

- A. Directly powering each maximal sprint through aerobic ATP production during ground contact
- B. Eliminating all glycolytic energy production during team sport activities
- C. No relevance because team sports are classified as entirely anaerobic with zero aerobic component
- D. Recovery capacity — replenishing phosphocreatine, clearing metabolic byproducts, and restoring homeostasis between high-intensity bouts to enable sustained repeated-effort performance

118. Interval training for a football wide receiver (3-5 second sprint routes with 25-40 second huddle rest) should use which work-to-rest ratio?

- A. 1:1 targeting the oxidative system with equal work and rest durations
- B. 1:5 to 1:8 targeting the phosphagen system with near-complete PCr recovery between sprints
- C. 1:20 with complete 2-3 minute recovery between each individual sprint effort

D. No structured rest because all conditioning should be continuous for 60 minutes

119. Tempo running at lactate threshold intensity (75-85% HRmax) for 20-30 minutes develops which specific physiological adaptation?

- A. Maximum sprint speed through phosphagen system enhancement at maximal intensity
- B. Explosive power through rapid force development during each running stride
- C. The body's capacity to sustain higher absolute intensities before lactate accumulation exceeds clearance — effectively raising the lactate threshold to a higher percentage of VO<sub>2</sub>max
- D. Flexibility through prolonged eccentric loading of the lower extremity during each stride

120. Active recovery — low-intensity exercise below 50% HRmax the day after intense training — provides which primary proposed benefit?

- A. Promotes blood flow to recovering tissues and facilitates metabolic waste removal — the circulatory benefit is the primary mechanism for improved subjective recovery
- B. Completely eliminates all muscle soreness within 10 minutes of initiation
- C. Produces the same adaptive training stimulus as a high-intensity training session
- D. Replaces the need for sleep by providing identical recovery benefits in less time

121. During a front squat, maintaining high elbows throughout the movement is critical. If elbows drop during the descent, the consequence is which of the following?

- A. Improved quadriceps activation from the altered torso angle and center of gravity shift
- B. Enhanced thoracic extension and reduced demand on the upper back stabilizers
- C. Increased biceps activation that supports the bar in the rack position on the deltoids
- D. The bar rolls forward off the anterior deltoids, creating dangerous loss of control and excessive wrist and elbow stress

122. A reverse lunge is preferred over a forward lunge for athletes with anterior knee sensitivity because it provides which biomechanical advantage?

- A. Greater compressive force on the patellofemoral joint for cartilage strengthening purposes
- B. Reduced shear force on the front knee because stepping backward eliminates the eccentric deceleration demand on the front leg that occurs during forward lunging
- C. Increased forward knee translation loading the quadriceps tendon more aggressively
- D. Complete elimination of all eccentric muscle action throughout the entire lowering phase

123. An athlete performing a Bulgarian split squat reports excessive anterior knee strain. Which technique modification most effectively reduces this stress?

- A. Moving the front foot closer to the bench to maximize forward knee translation over the toes
- B. Raising the rear foot to a higher bench to increase the total ROM at the front knee
- C. Moving the front foot further from the bench to create a more vertical shin angle, shifting primary loading emphasis from the knee extensors to the hip extensors
- D. Adding forward torso lean to shift the center of gravity directly over the front knee joint

124. A hex bar (trap bar) deadlift positions the athlete inside the bar with handles at the sides. Compared to a conventional barbell deadlift, this position provides which biomechanical advantage?

- A. Reduced moment arm on the lumbar spine because the load is centered closer to the body's center of mass, decreasing the flexion torque and overall spinal loading
- B. Greater moment arm on the lumbar spine increasing the training stimulus for the erector spinae
- C. Identical biomechanics to the conventional deadlift with no meaningful practical difference
- D. Increased grip demand because hex bar handles are always substantially thicker than standard bars

125. When spotting dumbbell pressing exercises, the spotter should apply assistance at which anatomical location?

- A. Directly on the dumbbells themselves to guide them along the intended trajectory
- B. At the elbows to create a fulcrum providing additional leverage for the pressing motion
- C. At the upper arms near the shoulder to stabilize the glenohumeral joint complex
- D. At the wrists near the athlete's hands — not at the elbows or at the dumbbells

126. Resistance bands combined with barbells create accommodating resistance. During a banded back squat, bands provide minimum resistance at the bottom (least stretched) and maximum at the top (fully stretched). This profile provides which training benefit?

- A. Elimination of all resistance at the bottom so the athlete can rest in the deepest position
- B. Maximum resistance in the mechanically strongest position (top) where free weights alone become easy, training force production through the complete ROM
- C. Constant resistance identical to free weights throughout the entire range of motion
- D. Maximum resistance at the bottom where the athlete is in the weakest mechanical position

127. A medicine ball rotational throw qualifies as a plyometric exercise only when performed with which essential characteristic?

- A. A deliberate 5-second isometric pause between catching and throwing phases
- B. Slow controlled tempo during both catching and throwing for maximum time under tension
- C. Maximum weight for developing absolute strength regardless of execution speed
- D. Maximal speed with minimal transition time between the eccentric catch and concentric throw to exploit the SSC

128. An Olympic lifting platform should be positioned with which primary safety consideration?

- A. Separated from general traffic areas with adequate clearance on all sides for dropped barbells and failed lifts
- B. Directly adjacent to cardio equipment for convenient circuit transitions between exercises
- C. Against mirrors so athletes can monitor technique during heavy Olympic lifting attempts
- D. In the center of the facility surrounded by other training stations for motivational atmosphere

129. A specialist trains 30 athletes with 10 available squat racks. The optimal organizational strategy is which of the following?

- A. Groups of 3 per rack rotating between squatting, spotting, and resting for continuous workflow with supervision
- B. All 30 athletes performing bodyweight squats while waiting for available racks
- C. All 30 observing one demonstration at a single rack for the entire training session
- D. Eliminating squats entirely because the facility lacks sufficient equipment for the group size

130. Collars are required on all barbell exercises. The safety rationale is which of the following?

- A. Increasing the total barbell weight for additional training resistance
- B. Preventing plates from sliding off during exercise, which could cause asymmetric loading, loss of control, and injury
- C. Improving the athlete's grip by adding friction to the bar surface
- D. Collars are decorative accessories with no functional safety purpose in the training environment

131. An athlete's program includes power snatches, front squats, incline bench press, single-arm rows, dumbbell lateral raises, and dead bugs. Correct exercise order places which exercise first?

- A. Dead bugs to pre-activate core stabilizers before any compound movement

- B. Dumbbell lateral raises because isolation exercises should precede all compound movements
- C. Power snatches — the explosive exercise requiring the highest neuromuscular coordination, performed when the athlete is freshest
- D. Single-arm rows because pulling exercises should always be performed before pressing exercises

132. When spotting a bench press with a single spotter behind the head, the recommended grip is which of the following?

- A. An alternated grip (one pronated, one supinated) close to center for maximum security and symmetric upward force application
- B. A wide pronated grip matching the athlete's grip width at the ends of the barbell
- C. No grip on the bar — hands placed on the athlete's elbows for leverage assistance
- D. A supinated grip at the extreme ends of the bar near the weight plates

133. An athlete explosive on the field but struggling with heavy barbell lifts has which specific training deficiency?

- A. A maximal strength deficit — explosive field ability outpaces force production capacity; heavy resistance training (85%+ 1RM) develops the larger force foundation supporting even greater explosive output
- B. Excessive explosive ability that cannot be developed further through any training modality
- C. Only long-distance running is needed because aerobic fitness determines explosive performance
- D. Only flexibility training is needed because ROM is the sole determinant of barbell strength

134. Correct Romanian deadlift (RDL) technique includes which combination of standards?

- A. Full knee lockout with deliberate lumbar rounding to maximize hamstring stretch at the bottom
- B. Slight constant knee flexion maintained throughout, flat neutral spine, hip hinge pattern, and bar tracking close to the legs during descent and ascent

- C. Deep knee flexion to 90 degrees with hips dropping below the knees in a conventional squat
- D. Alternating between full knee extension and deep flexion during each repetition

135. A training program for a swimmer includes pull-ups, internal/external rotation exercises, and core anti-rotation work. This selection addresses which sport-specific needs?

- A. Only lower body power because kicking determines swimming speed exclusively
- B. Only flexibility because ROM is the sole quality relevant to competitive swimming
- C. Upper body pulling strength for the swim stroke, rotator cuff injury prevention for the repetitively stressed shoulder, and trunk stability for force transfer during swimming
- D. Only cardiovascular endurance because swimming requires no upper body strength

136. The Pallof press trains the core to resist which specific force?

- A. Rotational force — an external load attempts to twist the torso while the athlete maintains neutral alignment, developing the anti-rotation stability critical for spinal protection during athletic movements
- B. Spinal extension force in the sagittal plane during overhead pressing movements
- C. Spinal flexion force in the sagittal plane during crunch and sit-up exercises
- D. Lateral flexion force in the frontal plane during side-stepping athletic movements

137. Before an athlete attempts the full snatch, which mobility prerequisite must be assessed?

- A. Only ankle dorsiflexion because the snatch is exclusively a lower body exercise
- B. Only wrist flexion because the wide grip places minimal demand on shoulder mobility
- C. No mobility prerequisites exist because all athletes can safely perform the snatch immediately
- D. Overhead squat mobility — the ability to maintain a stable, locked-arm overhead position while squatting to full depth with an upright torso

138. Correct push-up execution includes which combination of technical standards?

- A. Hips sagging toward the floor creating a visible swayback position throughout the movement
- B. A straight line from head to heels with core braced, chest touches or nearly touches the floor, and elbows track at approximately 45 degrees from the torso
- C. Elbows flared to 90 degrees from the torso regardless of shoulder comfort or safety
- D. Partial ROM with elbows bending only 10-15 degrees per repetition

139. Conditioning for an offensive lineman (4-7 second plays, 25-40 second rest) should use which protocol?

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

140. Cable face pulls target the posterior deltoids and external rotators. The cable should be set at which height and the athlete should pull toward which target?

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

## PROGRAM DESIGN (Questions 141–184)

141. A needs analysis for a competitive 1500-meter runner identifies that the race lasts approximately 3:30 to 4:15 of near-maximal effort. Based on this duration and intensity, which energy system combination is most critical?

- A. Exclusively the phosphagen system because the initial starting sprint determines the outcome
- B. Only slow-twitch fiber recruitment through exclusive long-distance running at low intensity
- C. No specific energy system is relevant to the 1500-meter event distance
- D. The aerobic system as the primary contributor (approximately 60-70% of total energy) supplemented by the glycolytic system (approximately 25-35%) and the phosphagen system for the kick finish

142. A strength and conditioning specialist classifies exercises. A barbell push jerk involves a rapid dip-and-drive followed by dropping under the bar into a partial squat receiving position. This exercise is classified as a power exercise because it meets which criteria?

- A. It is performed on a machine at slow tempo for muscle isolation
- B. It is structural (loads the spine), performed explosively (rapid leg drive with overhead receiving), and involves multiple large muscle groups in a coordinated explosive movement
- C. It targets only a single joint with a small muscle group at light resistance
- D. It is identical to a strict overhead press with no explosive or receiving component

143. In a session containing the hang clean, back squat, dumbbell bench press, lat pulldown, triceps pushdown, and front plank, correct NSCA exercise order places which exercise first?

- A. Triceps pushdown because isolation exercises should always precede compound movements
- B. Front plank because core stability should be established before any loaded exercise
- C. Hang clean — the power/explosive exercise requiring the highest neuromuscular coordination, performed when the athlete is freshest
- D. Lat pulldown because pulling exercises should always be performed before pushing exercises

144. For a novice athlete with 3 months of experience, the most appropriate training frequency and format is which of the following?

- A. 2-3 sessions per week using total-body training with moderate loads (60-70% 1RM), higher repetitions (10-15), and emphasis on technique mastery
- B. 6 sessions per week using an advanced body-part split with maximal loads from every session
- C. 1 session per month at maximal loads to failure on every exercise
- D. Daily sessions using only machine isolation exercises at maximum intensity

145. Training at loads  $>85\%$  1RM for  $\leq 6$  repetitions with 2-5 minutes rest primarily develops which physical quality?

- A. Muscle hypertrophy through moderate loading with metabolic stress accumulation
- B. Muscular endurance through sustained high-repetition work under fatigue
- C. Cardiovascular fitness through sustained elevated heart rate during the session
- D. Maximal strength through neural adaptations — increased motor unit recruitment, improved rate coding, and enhanced intermuscular coordination

146. An athlete's tested 1RM on the back squat is 165 kg. A strength protocol prescribes 5 sets of 4 at 85% 1RM with 3-minute rest. The prescribed training load is which of the following?

- A. 165 kg per set using 100% of 1RM for all working sets
- B. Approximately 140 kg per set ( $165 \times 0.85 = 140.25$ , rounded to 140 kg)
- C. 83 kg per set calculated as 50% of the 1RM for safety purposes
- D. 200 kg per set calculated by adding 35 kg to the 1RM

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

- A. Maximal strength requiring complete phosphocreatine and neural recovery between all sets

- B. Explosive power requiring full recovery for maximum ballistic quality on every repetition
- C. Muscle hypertrophy — maintaining elevated metabolic stress and the hormonal environment that supports the growth stimulus through incomplete recovery
- D. Aerobic endurance requiring sustained heart rate elevation throughout the resistance session

148. Daily undulating periodization (DUP) varies training emphasis within each week. The primary advantage of DUP over linear periodization is which of the following?

- A. More frequent exposure to different training stimuli within each week, preventing accommodation and allowing simultaneous development of multiple physical qualities
- B. DUP eliminates the need for any planning because all daily variation is completely random
- C. DUP never uses heavy loads making it inherently safer than every other periodization model
- D. DUP produces identical outcomes to performing the same workout at every session indefinitely

149. Linear periodization progresses through sequential phases with which characteristic pattern?

- A. Volume and intensity both increase simultaneously throughout the entire macrocycle
- B. Volume and intensity remain constant with no progression across any phase
- C. Intensity decreases while volume increases across sequential mesocycles
- D. Intensity gradually increases while volume gradually decreases across sequential mesocycles

150. Block periodization concentrates training on targeted qualities within each multi-week block. The typical three-block sequence for peaking at competition is which of the following?

- A. Realization → Transmutation → Accumulation in completely reverse order
- B. Accumulation (high volume, moderate intensity) → Transmutation (higher intensity, sport-specific) → Realization (low volume, peaking for competition)
- C. Competition → Transition → General preparation with no periodization structure
- D. Muscular endurance → Flexibility → Cardiovascular conditioning exclusively

151. During the in-season competitive period, maintaining intensity while reducing volume and frequency produces which expected outcome?

- A. Dramatic strength loss because any reduction in volume causes immediate detraining
- B. Significant additional gains from the reduced training load
- C. Strength and power maintenance because intensity — the most critical detraining-prevention variable — has been preserved
- D. Complete detraining within 48 hours regardless of maintained intensity

152. The transition period following the competitive season should focus on which objectives for approximately 2-4 weeks?

- A. Unstructured, low-intensity active recovery providing physical and psychological restoration, minor injury treatment, and motivation renewal before the next training cycle
- B. Maximal training intensity to immediately prepare for the following competitive season
- C. 6 months of complete bed rest with absolutely zero physical activity of any kind
- D. Elimination of the transition period because continuous maximal year-round training is optimal

153. For jump squat power development, peak power output typically occurs at which loading range?

- A. 85-95% of back squat 1RM using near-maximal loads at very slow velocity
- B. 50-70% providing balanced but suboptimal force and velocity contributions
- C. Equal peak power at all loads because loading does not affect power output
- D. 0-30% of back squat 1RM where lighter loading allows the high velocity needed to maximize the velocity component of the power equation

154. For the hang clean, peak power output is achieved at approximately which loading range?

- A. 0-10% of 1RM using only the empty barbell for maximum velocity

- B. 70-80% of 1RM — sufficient mass for meaningful force production while the ballistic nature of the exercise maintains velocity high enough for peak power expression
- C. 95-100% of 1RM using near-maximal loads at very slow velocity
- D. Equal peak power at all loads because loading has no effect on power output

155. Plyometric volume for beginner athletes should be which of the following?

- A. 250 foot contacts consisting exclusively of high-intensity depth jumps
- B. 500 foot contacts to maximize the first-session stimulus
- C. 80-100 foot contacts distributed across exercises of varying intensity
- D. 10 foot contacts regardless of exercise type or the athlete's training level

156. Plyometric sessions should be positioned when within a training day relative to other components?

- A. At the beginning of the session after a thorough warmup, when the athlete is fresh for maximal effort and proper technique
- B. At the end after heavy resistance training and conditioning to maximize accumulated fatigue
- C. Only on rest days with no other activity within 72 hours before or after
- D. Immediately after a 5-kilometer conditioning run to simulate game-day fatigue conditions

157. An athlete with a squat at the 90th percentile but vertical jump at the 28th percentile has which training deficiency?

- A. Insufficient maximal strength requiring even heavier squat loading despite the high ranking
- B. No deficiency because maximal strength is the sole determinant of vertical jump height
- C. Excessive flexibility impairing force transfer from the lower body to the ground
- D. A rate of force development deficit — adequate maximal strength but poor ability to express it rapidly, requiring increased explosive training (plyometrics, Olympic lifts, jump squats)

158. A conditioning program for a soccer team (90-minute matches with mixed aerobic and anaerobic demands) should include which comprehensive combination?

- A. Exclusively heavy resistance training with no conditioning of any type
- B. Aerobic base training (tempo runs, fartlek), anaerobic interval training (repeated sprints with sport-specific rest), and reactive agility conditioning
- C. Only long-distance running at low intensity five days per week
- D. Only static stretching for 60 minutes per session

159. The transition period following the competitive season should focus on which objectives?

- A. Maximizing training volume and intensity for immediate next-season preparation
- B. Complete cessation of all activity for a minimum of 6 months
- C. Physical and psychological recovery, minor injury treatment, and motivation restoration for 2-4 weeks
- D. Introducing entirely new sports the athlete has never practiced before

160. A return-to-play protocol for a unilateral lower extremity injury requires which objective criterion?

- A. Bilateral strength and functional symmetry within 10%, sport-specific movement competency, and medical clearance
- B. Subjective report of feeling ready with no objective testing required
- C. Ability to walk without a limp as the sole return-to-play criterion
- D. Completion of any group exercise class regardless of its content or relevance

161. A needs analysis for an ice hockey forward (45-60 second shifts, 2-3 minute bench rest) identifies which energy system as the primary conditioning target?

- A. Only the phosphagen system because individual skating strides last less than 1 second each

- B. Only the oxidative system because total game duration exceeds 60 minutes
- C. No energy system training because skating technique determines all performance outcomes
- D. The glycolytic system using 45-60 second high-intensity intervals with 2-3 minute rest replicating shift demands

162. For an advanced athlete (8 years training) preparing for a single major competition, which periodization model is most appropriate?

- A. A fixed program with zero variation performed identically for 52 consecutive weeks
- B. Block periodization with accumulation → transmutation → realization targeted to produce peak performance at the specific competition date
- C. A beginner program at 60% 1RM with no progressive overload or planned variation
- D. Random exercise selection with no structure, overload, or planned peaking strategy

163. After 22 weeks on the same program, an athlete's strength has plateaued. According to the principle of accommodation, the most appropriate intervention is which of the following?

- A. Continuing the identical program indefinitely because all plateaus resolve spontaneously
- B. Complete training cessation for 6 months before any reassessment or return to training
- C. Introducing variation in exercises, loads, volumes, or periodization model to provide novel stimuli overcoming the accommodation plateau
- D. Permanently reducing all loads to 25% of 1RM without any other programming change

164. A reconditioning program for an athlete returning from hamstring surgery should follow which general progression?

- A. Progressive loading from low-intensity through sport-specific movements, meeting bilateral symmetry criteria (within 10%) before unrestricted return to competition
- B. Immediate full-intensity sprinting and heavy deadlifts on the first day of medical clearance

- C. Exclusive upper body training for the remainder of the athlete's career
- D. Continued complete rest for 12 additional months regardless of medical clearance

165. A 12-week block periodization program for a powerlifter sequences the three blocks in which order?

- A. Realization → Transmutation → Accumulation in reverse order
- B. Competition → Transition → General preparation with no structure
- C. Flexibility → Cardiovascular conditioning → Muscular endurance exclusively
- D. Accumulation (high volume/moderate intensity) → Transmutation (higher intensity/sport-specific) → Realization (low volume/peaking)

166. Rest periods for muscular endurance training (<67% 1RM, 12+ reps) should be which duration?

- A. 2-5 minutes for complete phosphocreatine and neural recovery between each set
- B. 30 seconds or less to maintain elevated metabolic demand throughout the session
- C. 8-10 minutes for full systemic recovery before each endurance set
- D. No structured rest — continuous 90-minute exercise without any stopping

167. A protocol of 5×2 at 93% 1RM with 5-minute rest develops which physical quality?

- A. Muscular endurance through high-repetition sustained work
- B. Muscle hypertrophy through moderate loading with metabolic stress
- C. Maximal strength and neural adaptation through near-maximal loading with complete recovery
- D. Cardiovascular fitness through sustained elevated heart rate during the session

168. Volume load calculation:  $5 \times 5 \times 135$  kg on the back squat equals which total?

- A. 3,375 kg calculated as  $5 \times 5 \times 135$  using the standard volume load formula
- B. 675 kg calculated as sets multiplied by the load alone
- C. 25 repetitions calculated as sets multiplied by repetitions only
- D. 1,350 kg calculated as repetitions multiplied by load without the sets component

169. For a novice athlete's first 4-6 weeks, the loading strategy should emphasize which approach?

- A. Maximal loads at 95% 1RM with single repetitions from the very first training session
- B. Only plyometric depth jumps from maximum-height boxes with no foundational strength work
- C. No resistance training for 12 months while focusing exclusively on flexibility and stretching
- D. Moderate loads (60-70% estimated 1RM) with higher repetitions (10-15) emphasizing technique mastery, work capacity development, and connective tissue adaptation

170. Plyometric training frequency of 2-3 sessions per week with 48-72 hours between sessions is recommended primarily because of which physiological requirement?

- A. The recovery time is purely arbitrary with no physiological basis or justification
- B. Adequate recovery of musculotendinous structures experiencing significant eccentric loading during plyometric exercises — tendons adapt slower than muscle and require longer recovery
- C. The interval is needed exclusively for cognitive processing of plyometric movement patterns
- D. Recovery is needed only for the cardiovascular system to return to resting baseline levels

171. An athlete's training log: Week 1 =  $4 \times 8$  at 70%, Week 3 =  $4 \times 6$  at 78%, Week 5 =  $4 \times 5$  at 83%, Week 7 =  $4 \times 3$  at 89%. This pattern characterizes which periodization model?

- A. Daily undulating periodization with within-week variation of intensity and volume

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

172. Developing both maximal strength and explosive speed in a sprinter's weekly plan requires which approach?

- A. Combining heavy strength training (85%+ 1RM) on some days with explosive exercises (Olympic lifts, plyometrics, jump squats at 30-50% 1RM) on others — addressing both ends of the force-velocity continuum
- B. Training exclusively with heavy loads above 90% for every exercise and session
- C. Training exclusively with bodyweight exercises at maximum velocity for all sessions
- D. Eliminating all resistance training and relying solely on sprint practice for physical development

173. A deload week after three loading weeks (volume reduced ~40%, intensity maintained) serves which purpose?

- A. Testing the athlete's 1RM on all exercises under maximally fatigued conditions
- B. Permanently reducing the training load because the athlete has reached their genetic ceiling
- C. Eliminating all training stimulus so the athlete must restart the program from the very beginning
- D. Managing accumulated fatigue while maintaining neuromuscular stimulus, allowing recovery and supercompensation before the next loading cycle

174. A rower's needs analysis identifies aerobic endurance, pulling strength, core stability, and lower body drive. Which exercise combination addresses all needs?

- A. Exclusively distance running and cycling with no resistance training of any type
- B. Rowing-specific conditioning, rows/pull-ups for pulling, anti-extension/anti-rotation core, and front squats/RDLs for lower body drive

- C. Only biceps curls and wrist curls because rowing is exclusively arm-driven
- D. Only depth jumps because explosive power is the sole quality relevant to rowing

175. A martial artist competing in 3-minute rounds with 1-minute rest should primarily target which energy system?

- A. Only the phosphagen system because individual strikes last less than 0.5 seconds
- B. Only the oxidative system because total fight duration exceeds 5 minutes
- C. The glycolytic system — 3-minute rounds of sustained high-intensity fighting fall within the glycolytic-dominant range, supported by phosphagen for explosive techniques and aerobic for between-round recovery
- D. No energy system training because martial arts technique alone determines competitive outcome

176. In-season strength maintenance requires which variable to be preserved to prevent detraining?

- A. Training intensity (% 1RM) — research identifies this as the most critical variable; volume and frequency can be reduced while maintained intensity preserves neural and muscular adaptations
- B. Training volume at full preparatory-period levels throughout the entire competitive season
- C. Frequency at 5 sessions per week regardless of competition schedule or travel demands
- D. Exercise variety with completely new exercises at every single training session

177. The annual training plan should organize the year in which chronological sequence?

- A. Competition → Transition → General preparation → Specific preparation
- B. Transition → Competition → General preparation → Specific preparation
- C. Specific preparation → General preparation → Transition → Competition
- D. General preparation → Specific preparation → Competition → Transition

178. A protocol of 4×12 at 70% 1RM with 60-second rest targets which adaptation?

- A. Maximal strength through heavy loading with complete neural recovery between sets
- B. Muscle hypertrophy — moderate loading provides mechanical tension, higher repetitions and short rest create metabolic stress, and the combined stimulus drives the protein synthesis and cellular signaling for growth
- C. Explosive power through ballistic high-velocity movement at submaximal loads
- D. Phosphagen system development through brief maximal-intensity efforts

179. A decathlete competing in 10 events needs sprint speed, endurance, jumping power, throwing power, and skills simultaneously. The most suitable periodization approach is which of the following?

- A. Block periodization focusing on one event for 4 weeks before switching to the next
- B. Linear periodization training only sprinting for 6 months then only throwing for 6 months
- C. Concurrent training with undulating periodization addressing multiple qualities simultaneously throughout the year
- D. No structured training because event variety makes any periodization model impossible

180. An athlete with a wrist injury preventing barbell gripping should train which lower body exercises?

- A. Belt squats, leg press, goblet squats with modified grip — exercises not requiring conventional barbell grip
- B. No training of any kind until the wrist is fully healed without any modifications
- C. Only upper body machine exercises to maintain strength in uninjured areas
- D. Heavy barbell back squats with standard grip because the wrist will adapt under load

181. A goalkeeper's demands include explosive saves and 2-5 second sprints with variable rest. The conditioning work-to-rest ratio should be which of the following?

- A. 1:1 targeting the oxidative system with equal work and rest durations
- B. 1:3 targeting the glycolytic system with moderate recovery between efforts
- C. No structured rest because goalkeepers should train continuously for 90 minutes without breaks
- D. 1:8 to 1:12 targeting the phosphagen system with near-complete PCr recovery between explosive efforts

182. The general preparation phase emphasizes which foundational qualities?

- A. Sport-specific power and speed for immediate competitive readiness
- B. A broad base of hypertrophy, general strength, work capacity, and aerobic fitness using a variety of exercises and methods
- C. Complete rest with no training for the entire general preparation phase
- D. Exclusively technical sport skill practice with no physical training component

183. The specific preparation phase shifts training emphasis to which focus?

- A. Maximum aerobic endurance through exclusive long-distance running at low intensity
- B. Complete rest to conserve energy for the upcoming competitive season
- C. Sport-specific qualities including power, speed, agility, and sport-specific conditioning
- D. Only flexibility training because all other qualities maintain automatically without training

184. A DUP weekly structure (Monday hypertrophy, Wednesday strength, Friday power) provides which primary advantage?

- A. More frequent exposure to different training stimuli within each week, preventing accommodation and enabling simultaneous multi-quality development

- B. DUP eliminates all planning because variation is entirely random
- C. DUP never uses heavy loads reducing injury risk below all other models
- D. Identical outcomes to performing the same workout at every session indefinitely

### **TESTING AND EVALUATION (Questions 185–206)**

185. Assessing lower body explosive power in 50 athletes during a 2-hour session requires which test?

- A. Laboratory isokinetic dynamometry at 25 minutes per individual athlete
- B. Force plate analysis with 3D motion capture requiring specialized technicians
- C. Underwater weighing to assess body composition as a power proxy
- D. The vertical jump (CMJ) using a Vertec — valid, reliable, practical for large groups, and efficiently administered

186. A test producing consistent, reproducible scores across repeated administrations under identical conditions demonstrates which psychometric property?

- A. Face validity based on apparent relevance to the sport being assessed
- B. Reliability — consistency and reproducibility ensuring observed changes reflect true performance improvement
- C. Construct validity measuring an underlying physiological quality accurately
- D. Criterion validity demonstrated through comparison with a gold-standard measurement

187. During 1RM testing, an athlete lifts 145 kg successfully with proper technique then fails at 150 kg. The recorded 1RM is which value?

- A. 150 kg because the athlete attempted this weight despite failing to complete it
- B. 147.5 kg as the average of the successful and failed attempts

- C. 145 kg — the last weight successfully lifted with acceptable technique through full ROM
- D. The test must restart because any failure invalidates all prior successful attempts

188. An athlete's CMJ is 68 cm and SJ is 56 cm. The 12 cm difference reflects which capacity?

- A. Stretch-shortening cycle utilization — stored elastic energy and stretch reflex from the countermovement enhancing concentric force production
- B. Maximum aerobic power during the vertical jump testing session
- C. Hamstring-to-quadriceps strength ratio as an ACL injury risk predictor
- D. Absolute maximal quadriceps strength independent of contraction velocity

189. Assessing aerobic capacity in 50 soccer players outdoors with minimal equipment (cones, sound system) requires which test?

- A. Direct  $\text{VO}_2\text{max}$  on a laboratory treadmill with metabolic cart and gas analysis
- B. Wingate anaerobic power test on a specialized cycle ergometer
- C. 1RM back squat as a lower body strength proxy for aerobic fitness
- D. The 20-meter beep test — requiring only cones and a sound system, administered to groups, providing valid aerobic capacity estimates

190. Skinfold body composition assessment involves which two-step calculation?

- A. Skinfolds directly produce body fat percentage without any intermediate calculation step
- B. Skinfolds entered into prediction equations to estimate body density, then converted to body fat percentage using equations such as the Siri formula
- C. Skinfolds estimate bone mineral density only with no relationship to body fat
- D. Skinfolds multiplied by body weight to produce fat mass in kilograms directly

191. BIA body composition accuracy is most significantly affected by which variable?

- A. Ambient room temperature during the measurement session
- B. The brand of athletic shoes worn during the assessment
- C. The athlete's hydration status — affecting electrical conductivity and potentially altering body fat estimates by several percentage points
- D. The number of other people present in the testing room

192. Electronic sprint timing is more accurate than hand timing because it eliminates which error?

- A. The human timer's reaction time variability (approximately 0.1-0.3 seconds) — a substantial proportion of total sprint time that obscures real performance differences
- B. Wind resistance affecting the athlete's running velocity during testing
- C. Temperature effects on muscle contraction speed during cold weather
- D. Lane marking color affecting athlete motivation and effort

193. A bilateral single-leg hop: right = 45 cm, left = 36 cm (approximately 20% asymmetry). Clinical thresholds suggest which of the following?

- A. Normal bilateral variation requiring no intervention or further assessment
- B. The right leg is overtrained and should be detrained to match the left
- C. The test was incorrectly administered invalidating all collected results
- D. Clinically significant asymmetry exceeding the 10-15% threshold warranting corrective programming and possible medical evaluation

194. An athlete's test results: squat = 86th percentile, vertical jump = 30th, pro agility = 56th, 1.5-mile run = 62nd. The highest programming priority is which quality?

- A. Maximal strength at the 86th percentile

- B. Explosive power (30th percentile vertical jump) — disproportionately low relative to high strength, indicating a rate of force development deficit requiring explosive training
- C. Agility at the 56th percentile
- D. Aerobic endurance at the 62nd percentile

195. The most critical factor for valid longitudinal testing comparisons is which of the following?

- A. Using different tests at each time point to prevent adaptation to testing procedures
- B. Allowing athletes to choose their conditions at each session for maximum comfort
- C. Identical conditions across sessions — same warmup, equipment, test order, time of day, and environmental conditions
- D. Testing immediately after heavy training to evaluate performance under fatigued conditions

196. An athlete returning from ACL reconstruction achieves 86% bilateral hop symmetry. Based on the 90% criterion, the recommendation is which of the following?

- A. Continue progressive strengthening because the surgical leg has not met the 90% symmetry threshold required for return-to-play consideration
- B. Return to unrestricted competition because 86% is close enough to the threshold
- C. Bilateral hop testing has no relevance to ACL return-to-play decision-making
- D. The athlete should be permanently restricted from all competitive sport participation

197. A force plate during vertical jump testing measures which variables that simpler methods cannot?

- A. Only jump height from standing reach minus jumping reach measurement
- B. Only the athlete's body weight measured immediately before the test
- C. Peak GRF, rate of force development, impulse, and power output in addition to jump height
- D. Only flight time from the moment of takeoff to the moment of landing

198. The sit-and-reach test has which primary limitation as a flexibility assessment?

- A. It requires expensive laboratory equipment unavailable in field testing settings
- B. Primarily measures hamstring and lower back flexibility, does not assess other joints, and is influenced by limb proportions — providing no whole-body flexibility assessment
- C. It takes more than 30 minutes per athlete to administer properly
- D. It measures only shoulder flexibility with no relevance to the lower body

199. Goniometric assessment provides which advantage over the sit-and-reach test?

- A. Goniometry is less accurate than the sit-and-reach for every joint in the body
- B. Identical information with no additional diagnostic or clinical value
- C. Joint-specific ROM measurements at any individual joint, identifying specific restrictions the sit-and-reach cannot detect
- D. Measurement limited exclusively to hip ROM with no application for any other joint

200. Performance testing should be conducted at which intervals throughout the training year?

- A. At the beginning and end of each major training phase and at pre/post-season time points
- B. Daily to capture maximum data granularity on performance fluctuations
- C. Only once at the beginning of the athlete's career with no subsequent testing
- D. Randomly with no planned schedule to prevent athletes from preparing for tests

201. Submaximal 1RM prediction equations are most accurate within which repetition range?

- A. 25-30 repetitions providing maximum statistical data points for prediction
- B. 15-20 repetitions to demonstrate full muscular endurance capacity
- C. Exactly 1 repetition eliminating the need for any prediction equation

D. 10 or fewer — the rep-to-1RM relationship becomes less linear at higher counts introducing greater error

202. The standardized 1RM protocol includes how many warmup sets before maximal attempts?

A. 3-4 progressively heavier warmup sets (approximately 50%, 70%, 80-85% estimated 1RM) before maximal singles

B. No warmup — attempt estimated 1RM on the very first set

C. One set of 50 light repetitions for maximum blood flow

D. 10 sets of 10 at increasing loads for complete physiological preparation

203. The T-test assesses multidirectional movement through which pattern?

A. Straight-line 40-yard sprint with no direction changes

B. Repeated vertical jumps for 60 seconds measuring total accumulated height

C. Forward sprint, lateral shuffle in both directions, and backward run arranged in a T-shaped pattern

D. Agility ladder drill with predetermined fixed footwork patterns

204. An athlete's vertical jump hasn't improved after 12 weeks of plyometric training. Their squat is  $1.1\times$  body weight. The appropriate modification is which of the following?

A. Continue identical plyometric programming for 12 additional weeks without change

B. Complete cessation of all training for 6 months before reassessment

C. Eliminate all lower body training and focus only on upper body development

D. Add heavy resistance training to build the strength base — squat below  $1.5\times$  body weight limits SSC effectiveness for plyometric power gains

205. The Cooper 12-minute run and 1.5-mile run both estimate  $VO_{2max}$ . Their shared limitation is which of the following?

- A. Both require expensive laboratory metabolic analysis equipment
- B. Both can only be administered to a single athlete at a time
- C. They depend on self-pacing at maximal effort, influenced by motivation and pacing experience
- D. Neither can distinguish between athletes of different aerobic fitness levels

206. A pre-season battery for a collegiate basketball team should assess which performance domains?

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

### **ORGANIZATION AND ADMINISTRATION (Questions 207–220)**

207. A facility accommodating 50 athletes simultaneously needs minimum floor space (NSCA minimum 40 sq ft/athlete) of which of the following?

- A. 500 sq ft based on 10 sq ft per athlete
- B. 1,000 sq ft based on 20 sq ft per athlete
- C. 2,000 sq ft ( $50 \times 40$ ), with the upper guideline of 60 sq ft producing 3,000 sq ft
- D. 5,000 sq ft based on 100 sq ft per athlete

208. An emergency action plan should be rehearsed at which minimum frequency?

- A. At least annually with all staff participating, and ideally more frequently
- B. Only once when the facility first opens with no subsequent rehearsals
- C. Every 10 years aligned with major facility renovations
- D. Only after an emergency has occurred to evaluate the response

209. CSCS professionals must maintain current certification in which emergency skill?

- A. Advanced cardiac life support at physician training level
- B. EMT certification at paramedic level
- C. Wilderness first responder for remote environments
- D. CPR and AED use from a recognized provider — ensuring immediate life-saving capability

210. The "standard of care" in negligence law refers to which concept?

- A. Maximum insurance coverage required by state law for fitness facilities
- B. The degree of care, skill, and diligence a reasonably competent professional with similar training would exercise under similar circumstances
- C. Minimum professional salary demonstrating competence in the field
- D. Continuing education credits required for annual recertification

211. A signed waiver generally does NOT protect against which claim type?

- A. Claims based on inherent risks clearly disclosed and voluntarily assumed by the participant
- B. Claims for normal muscle soreness following an appropriately designed training session
- C. Claims from participants who explicitly acknowledged documented inherent training risks

D. Willful misconduct — reckless conduct — safety disregard going beyond ordinary negligence

212. An athlete asks for chronic knee pain diagnosis and rehabilitation prescription. The CSCS should do which of the following?

A. Refer to a qualified medical professional (physician, athletic trainer, physical therapist) — diagnosis and rehabilitation are outside the CSCS scope of practice

B. Diagnose the condition and prescribe comprehensive rehabilitation protocols independently

C. Prescribe anti-inflammatory medication based on the athlete's body weight and symptoms

D. Perform a surgical evaluation to determine the extent of structural knee damage

213. Which combination of activities falls within the CSCS scope of practice?

A. Diagnosing injuries through physical examination and imaging interpretation

B. Prescribing meal plans with specific caloric targets and macronutrient ratios

C. Providing psychological counseling for clinical depression and anxiety disorders

D. Designing periodized programs, teaching technique, administering tests, and managing the facility

214. Damaged equipment should be handled by which protocol?

A. Continued use until complete failure because replacement is expensive

B. Immediately removed from service, tagged out of order, documented in maintenance logs, and repaired or replaced before return to use

C. Hidden from athletes to prevent concern about equipment quality

D. Only the manufacturer can evaluate damage, so nothing is done until their scheduled visit

215. When a coach's demands conflict with evidence-based safety, the CSCS should do which of the following?

- A. Always comply because the coach has final authority over all program decisions
- B. Resign immediately without any discussion or resolution attempt
- C. Decline unsafe practices, explain the evidence-based rationale, and advocate for athlete safety
- D. Implement the demands but document personal objections in a private journal

216. Supervision ratios should adjust based on which factors?

- A. Exercise complexity, athlete experience level, and staff qualifications
- B. Only the total number of athletes regardless of exercises being performed
- C. Only the time of day the training session takes place
- D. Only the physical dimensions of the facility without considering activities

217. Record keeping should include which documents for programming and legal protection?

- A. Only financial statements and tax returns
- B. Only social media posts documenting training sessions
- C. Only the head coach's practice plans and game film
- D. Athlete training logs, testing data, waivers, medical clearances, equipment maintenance records, and incident reports

218. A colleague without credentials independently teaches heavy power cleans to inexperienced athletes. The response should be which of the following?

- A. Ignore it because it doesn't involve the specialist's own athletes

B. Address the concern with the colleague and/or supervisor — unqualified instruction of demanding exercises creates significant safety and liability risk

C. Encourage the colleague to increase loads to accelerate development

D. Post about it on social media to publicly expose the unsafe practice

219. A facility requires closed-toe athletic shoes. An athlete arrives in sandals. The response should be which of the following?

A. Allow training because footwear enforcement is unnecessarily strict

B. Allow barefoot training as a suitable alternative to the prohibited sandals

C. Enforce the policy — the athlete cannot train until returning with proper closed-toe athletic footwear

D. Permanently modify the facility policy to accommodate this athlete's preference

220. The NSCA professional standards establish that the CSCS holds which authority regarding the program?

A. Ultimate professional authority and responsibility for the design, implementation, and supervision of the strength and conditioning program

B. No authority because the sport coach makes all training decisions exclusively

C. Authority limited to equipment purchasing and facility decoration only

D. Authority only during the off-season with in-season decisions deferred to coaches

# PRACTICE EXAM 9 — ANSWER KEY

## WITH EXPLANATIONS

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### SECTION 1 — SCIENTIFIC FOUNDATIONS

#### EXERCISE SCIENCE (Questions 1–52)

1. D — Fiber type distribution has a significant genetic component (identical twins share the base distribution), but chronic training influences proportions — particularly the well-documented IIX-to-IIa shift seen in the sprinter and the reduced IIX in both trained athletes. Neither twin's profile can be explained by genetics or training alone.
2. B — At 30 degrees of knee flexion (more extended), the quadriceps are in a shorter position where actin-myosin overlap becomes suboptimal. The length-tension relationship predicts reduced force at lengths deviating from the optimal resting length, and the external moment arm of the resistance also changes with joint angle.
3. A — Early gains (50% strength, 2% hypertrophy) are predominantly neural — improved motor unit recruitment, rate coding, and intermuscular coordination. Later gains (8% strength, 14% hypertrophy) shift toward structural adaptation as the nervous system approaches its adaptive ceiling. This neural-to-structural transition characterizes novice-to-intermediate progression.
4. C — The power stroke is the force-generating step where the myosin head pivots, pulling actin toward the M-line while releasing ADP and inorganic phosphate. This conformational change, occurring simultaneously across thousands of cross-bridges, produces all skeletal muscle contractile force.
5. D — Chronic heavy training reduces the GTO's inhibitory influence on alpha motor neurons, allowing trained athletes to voluntarily produce force closer to the structural capacity of their musculotendinous units. This neural disinhibition is a significant contributor to strength gains beyond what hypertrophy alone provides.
6. B — Greater net upward force (2,318 vs. 1,518 N) produces greater upward acceleration ( $F = ma$ ), which translates to higher takeoff velocity and jump height. Only force exceeding body weight contributes to upward acceleration — the first 882 N simply supports the athlete's mass against gravity.
7. C — The exponential rise from 1.8 mmol/L at 11 km/h to 5.2 mmol/L at 13 km/h identifies the lactate threshold — the running speed where lactate production began exceeding clearance

capacity. Below this threshold, production and clearance were balanced; above it, accumulation accelerates.

8. A — The 6-second isometric contraction generates high tension activating the GTO, which sends inhibitory signals through an Ib interneuron reducing alpha motor neuron activity to the hamstrings. This autogenic inhibition temporarily decreases muscle tone and resistance to stretch, allowing a greater subsequent ROM.
9. D — A 45-second all-out effort falls within the glycolytic-dominant range. Rapid glycogen breakdown produces hydrogen ions that accumulate, reduce intracellular pH, and impair cross-bridge cycling and enzymatic function — causing the severe burning, high lactate, and progressive power decline.
10. B — The RER decrease from 0.87 to 0.77 reflects increasing reliance on fat oxidation as glycogen depletes over 4 hours. As carbohydrate becomes less available, the body shifts toward fat pathways, producing the lower CO<sub>2</sub>-to-O<sub>2</sub> ratio characteristic of fat metabolism.
11. C — Oxygen combines with electrons and hydrogen ions to form water at the end of the ETC. Without oxygen as the final electron acceptor, the chain halts, NADH and FADH<sub>2</sub> accumulate in reduced form, and aerobic ATP production ceases entirely.
12. A — The phosphagen system dominates the 10-12 second 100-meter sprint. Work-to-rest ratios of 1:12 to 1:20 (2-4 minutes rest) allow near-complete PCr resynthesis, maintaining maximal phosphagen contribution and training quality for each subsequent effort.
13. D — Fat oxidation produces ATP at a rate too slow to match high-intensity energy demand. Despite yielding far more ATP per molecule, the rate limitation — not total yield — determines which substrate dominates. Carbohydrate pathways produce ATP faster to meet rapid demands.
14. B — After stroke volume plateaus at 40-60% of VO<sub>2</sub>max, further cardiac output increases depend on continued heart rate increases through sympathetic activation. Heart rate rises linearly with intensity until approaching the age-predicted maximum.
15. C — The ground reaction force must exceed the combined weight of the athlete plus the barbell (total system weight) for net upward acceleration. Any force below this threshold merely decelerates the system; only force above total system weight produces positive upward acceleration.
16. A — Torque = force × moment arm. The maximum horizontal distance between the bar and L4-L5 at mid-shin creates the greatest moment arm, producing the highest flexion torque demand on the hip and back extensors at this specific point.
17. D — Hydrogen ions from glycolytic metabolism are buffered by the bicarbonate system ( $H^+ + HCO_3^- \rightarrow H_2O + CO_2$ ). The additional CO<sub>2</sub> produced must be expelled through increased ventilation, causing the disproportionate rise in breathing that defines the ventilatory threshold.

18. B — Peak power occurs at approximately 30-60% of maximal force, where the combination of moderate force and moderate-to-high velocity produces the greatest force × velocity product. The extremes of the curve (maximum force or maximum velocity) both yield lower power output.
19. C — Passive ROM exceeds active ROM because external force moves the joint beyond the limit of voluntary muscular effort. The 16-degree difference reflects the neuromuscular and motor control limits of active motion versus the structural limits of passive mobility.
20. A — Cardiac output = HR × SV = 46 × 115 = 5,290 mL/min (approximately 5.3 L/min). This normal resting cardiac output demonstrates how the trained athlete's high stroke volume compensates for the low resting heart rate.
21. D — Selective redistribution prioritizes delivery to the most metabolically active tissues. Vasodilation in working muscles (from local metabolic signals) increases their blood flow, while vasoconstriction in non-essential organs (from sympathetic activation) reduces their flow — directing 80-85% of cardiac output to working muscles.
22. B — Metabolic stress from short rest periods — elevated lactate, hydrogen ion accumulation, and reduced pH — is the primary stimulus for acute GH release. The 75-second rest prevents full recovery between sets, maximizing the metabolic conditions that trigger GH secretion.
23. C — A declining T:C ratio with stagnated performance and persistent fatigue over 6 weeks suggests overreaching or early overtraining. The catabolic environment is outpacing anabolic recovery, indicating the need for reduced training stress and enhanced recovery.
24. A — Wolff's Law predicts bone remodeling from mechanical stress. Ground-based resistance exercises with impact activities apply large compressive and impact forces directly to weight-bearing bones, providing the greatest osteogenic stimulus for increasing BMD.
25. D — Aerobic capacity declines most rapidly during detraining — measurable within 1-2 weeks with significant losses by 10 weeks. Maximal strength is more resistant, maintaining for 2-4 weeks or longer. This hierarchy guides rehabilitation priorities.
26. B — Contact times exceeding 250 ms with declining height confirms fatigue and SSC loss. Plyometrics are quality-based — continuing degraded repetitions trains poor patterns with no power benefit. Terminate immediately to preserve training quality.
27. C — Research consistently shows vertical GRF during the brief 80-100 ms contact phase at max velocity is the primary factor distinguishing faster from slower sprinters. Faster sprinters produce greater vertical force relative to body weight.
28. A — The forward lean directs forces primarily horizontally backward against the ground. Newton's Third Law produces the equal forward-directed reaction force needed to overcome inertia and build forward momentum from a stationary start.

29. D — The trained cyclist's higher threshold (80% vs. 50%  $\text{VO}_2\text{max}$ ) reflects increased mitochondrial density, enhanced oxidative enzymes, greater capillarization, and improved fat oxidation — all reducing glycolytic dependence at any given workload.
30. B — The three SSC mechanisms: stored elastic energy in the musculotendinous unit, the stretch reflex from muscle spindle activation, and increased time for force development as tension builds during the eccentric phase before the concentric begins.
31. C — Third-class levers favor speed and range of motion at the distal end. Small muscle shortening produces large fast movement at the hand or foot — essential for throwing, kicking, and striking. The tradeoff: the muscle produces forces many times greater than the external load.
32. A — Slow jogging fails to develop explosive starting power, maximal sprint velocity, rapid RFD, and anaerobic capacity — the specific qualities determining sprint performance. The SAID principle requires the training stimulus to match the sport's demands.
33. D —  $\text{Torque} = (8 \times 9.81) \times 0.62 = 78.48 \times 0.62 \approx 48.7 \text{ N}\cdot\text{m}$ . Mass must be converted to Newtons (force) then multiplied by the perpendicular moment arm distance from the joint axis to the gravitational force line.
34. B — Eccentric force increases with lengthening velocity to a plateau 20-60% above isometric maximum. Athletes can safely lower loads exceeding their concentric 1RM, forming the basis for supramaximal eccentric training — a novel overload stimulus for strength and connective tissue.
35. C — Rapid muscular strength gains can outpace connective tissue strengthening due to tendons' lower metabolic activity and blood supply. This creates a window of increased injury risk requiring gradual progressive overload and appropriate recovery.
36. A — The mTOR pathway integrates signals from mechanical loading (IGF-1/MGF), amino acid availability (leucine), and hormonal stimulation (insulin, IGF-1). It is the central regulator determining the rate of new contractile and structural protein production.
37. D — The progressive RER increase from 0.75 to 0.98 describes the crossover concept — a shift from predominantly fat oxidation (low intensity) to predominantly carbohydrate oxidation (high intensity). The body requires faster ATP production rates that only carbohydrate pathways provide.
38. B — The Cori cycle recycles lactate into glucose in the liver, maintaining blood glucose for the glucose-obligate brain and working muscles as glycogen depletes. This metabolic recycling is critical for sustained exercise performance.
39. C — Two-minute high-intensity grappling periods fall within the glycolytic-dominant range. Conditioning should use matching interval durations at similar intensity with appropriate rest to develop sport-specific glycolytic capacity.

40. A — Cortisol breaks down amino acids from muscle protein for hepatic gluconeogenesis, providing glucose to the brain (obligatorily glucose-dependent) and other tissues during metabolic stress when glycogen stores are depleting.
41. D — Stable testosterone with decreased cortisol produces a favorable T:C ratio confirming positive adaptation. Combined with continued gains, adequate sleep, and subjective recovery, this profile validates the program's effectiveness.
42. B — Enhanced receptor density amplifies the anabolic signal at the tissue level — each testosterone molecule produces a stronger response. This potentially increases hypertrophy and strength gains even without changes in basal circulating hormone concentrations.
43. C — In the second-class calf raise lever, the effort arm (calcaneus to ball of foot) is longer than the resistance arm (ankle to ball of foot). This creates a mechanical advantage greater than one, favoring force production over speed.
44. A — Progressive T:C decline with declining 1RM, elevated resting HR, insomnia, and suppressed testosterone/elevated cortisol indicates overtraining syndrome. Aggressive intervention — reduced training, recovery phase, and medical evaluation — is required.
45. D — Retained myonuclei from prior training persist during detraining-induced atrophy. When training resumes, these additional nuclei accelerate protein synthesis, allowing faster recovery of muscle size and strength — explaining the "muscle memory" phenomenon.
46. B — BMI of 17.8, 9-month amenorrhea, 1,150 cal/day with 2.5 hours training, decreased lumbar BMD, and recurrent stress fractures represent RED-S — the interrelationship between chronic low energy availability, menstrual dysfunction, and decreased bone mineral density.
47. C — Post-exercise insulin stimulates amino acid uptake into muscle cells and inhibits protein degradation. Combined with adequate protein and carbohydrate, this creates a favorable anabolic environment supporting recovery and adaptation.
48. A — Vasodilation in working muscles reduces total peripheral resistance. Because diastolic pressure reflects peripheral resistance during cardiac relaxation, the reduced resistance counterbalances the increased cardiac output, preventing diastolic pressure from rising.
49. D — Individuals with uncontrolled hypertension or cardiovascular disease face serious risk because extreme transient pressure spikes may exceed the structural limits of compromised vessels or the functional capacity of a damaged heart.
50. B — Both produce 2,900 N, but Athlete A reaches peak in 150 ms vs. 280 ms — superior RFD producing greater impulse during limited ground contact time. Greater impulse means higher takeoff velocity and jump height despite identical peak force.

51. C — Explosive training (Olympic lifts, plyometrics, ballistic exercises) directly trains the neuromuscular system to produce force rapidly — the definition of RFD. Slow training at any load cannot develop the high-velocity neural drive required for rapid force production.
52. D — The myosin (thick) filaments do not shorten during contraction — only the relative position of actin sliding over myosin changes. Therefore the A-band, representing the full length of the myosin filaments, remains constant in width throughout contraction.

### **SPORT PSYCHOLOGY (Questions 53–75)**

53. D — Racing thoughts, worry about scoring, and fear of disappointment are cognitive anxiety symptoms requiring cognitive intervention. Thought stopping interrupts the negative pattern, and instructional self-talk redirects cognitive resources to task-relevant performance cues.
54. B — Observing a training partner of similar build and experience succeed provides vicarious experience — evidence that the task is achievable by someone of comparable capability. Vicarious experience is one of Bandura's four self-efficacy sources.
55. C — A precision shot requires steady hands, controlled breathing, and fine motor control — all degraded by excessive arousal. Low arousal prevents tremor, attentional narrowing, and fine motor impairment that degrade long-range accuracy.
56. A — Only a single outcome goal provides long-term direction but lacks daily behavioral guidance.
57. A — While a hierarchical combination of outcome, performance, and process goals is optimal, having at least an outcome goal provides long-term direction and competitive focus. The specialist should supplement this with performance benchmarks and daily process targets as the program develops.
58. D — Excellent practice with competitive underperformance, combined with worry, fear of failure, and negative self-talk, indicates choking under pressure. Excessive cognitive anxiety disrupts automatic motor execution of well-learned skills in high-stakes environments.
59. B — Muscle tension, elevated heart rate, and rapid breathing are somatic anxiety symptoms. PMR and diaphragmatic breathing directly target physiological activation by teaching tension release and engaging the parasympathetic nervous system.
60. C — Effective imagery engages visual (ball path), kinesthetic (leg swing and contact), auditory (ball striking net), and emotional (confidence of scoring) components simultaneously. Multi-sensory engagement creates the richest, most transferable mental rehearsal.
61. A — Highly variable performance, large errors, and heavy reliance on verbal instruction characterize the cognitive stage. The athlete is trying to understand what the movement requires — "What do I need to do?" — with inconsistent execution.

62. D — Random practice produces slower initial improvement but significantly better long-term retention and transfer. Constant task-switching forces deeper cognitive processing, building more robust motor representations that persist over time.
63. B — The guidance hypothesis states constant feedback creates dependency on external correction. Athletes wait for the coach rather than developing internal error-detection. Reducing frequency forces proprioceptive attention, building self-monitoring capabilities.
64. C — "Hips rose too fast and chest dropped" describes movement quality — how the lift was executed. This is knowledge of performance (KP), providing actionable technique information rather than outcome information (KR).
65. A — Memory consolidation during rest intervals stabilizes and transfers motor memories from short-term to long-term storage. Distributed practice allows this neurological process between bouts, producing more durable representations.
66. D — Progressive withdrawal, persistent motivation loss, feeling trapped, and emotional exhaustion over weeks are hallmark burnout symptoms — emotional exhaustion, depersonalization, and reduced sense of accomplishment.
67. B — Increasing isolation, persistent worthlessness, lost interest, and expressed hopelessness are potential warning signs of clinical depression. The specialist must recognize these and recommend professional mental health evaluation.
68. C — Extreme weight manipulation, meal avoidance, excessive exercise, and weight preoccupation are disordered eating warning signs. Referral to a qualified healthcare professional is mandatory — diagnosis and treatment are outside the CSCS scope.
69. A — Removing input violates autonomy, no feedback undermines competence, and isolating athletes destroys relatedness. All three basic needs are simultaneously violated, directly undermining intrinsic motivation.
70. D — RED-S in males produces suppressed testosterone, decreased BMD, impaired immunity, and declining performance. Chronic low energy availability drives these consequences regardless of sex.
71. B — Fear of re-injury is a recognized psychological barrier to return. Gradual movement reintroduction at progressive intensities builds confidence, while sport psychology referral addresses cognitive and emotional components.
72. C — Research consistently shows that athletes with significant psychological distress during rehabilitation have longer recovery times and higher re-injury rates. Psychological factors significantly influence outcomes.

73. A — The absolute speed and force change between the fastball and changeup, but invariant features (relative timing, relative force proportions, spatial pattern) remain constant. Variable parameters adapt the same GMP to different situations.
74. D — Past performance accomplishment is the most powerful self-efficacy source. Successfully completing 190 kg provides direct personal evidence of capability, creating the strongest confidence that 195 kg is achievable.
75. B — Scanning the entire defensive formation requires broad-external focus — perceiving multiple defenders, teammates, and spatial relationships simultaneously for tactical decision-making before initiating the fast break.
76. C — The front squat develops the upright torso, high-elbow rack position, and receiving posture that directly transfer to the power clean catch. Shared movement features create positive transfer.

### **NUTRITION (Questions 76–95)**

76. A — A 105 kg athlete at 2.2 g/kg/day requires 231 grams daily ( $105 \times 2.2 = 231$ ). This upper-end recommendation supports elevated protein synthesis, tissue repair, and anti-catabolic demands of heavy training.
77. D — Leucine is the key trigger for mTOR activation and protein synthesis initiation. Approximately 2-3 grams per meal ensures optimal stimulation of the protein synthetic machinery.
78. B — Chronically inadequate fat (below 15-20% of calories) impairs steroid hormone production (cholesterol is the testosterone precursor) and reduces fat-soluble vitamin absorption (A, D, E, K). Both consequences compromise health and adaptation.
79. C — Consuming 2.5 L/hr of plain water for 5 hours without sodium replacement dramatically dilutes blood sodium below safe levels. The massive intake relative to sweat sodium losses causes exercise-associated hyponatremia.
80. A — The maintenance-only approach (3-5 g/day) achieves full saturation in approximately 28 days — equally effective as loading for reaching the same endpoint, just requiring 4 weeks instead of 1.
81. D — A 70 kg athlete at 3 mg/kg requires 210 mg ( $70 \times 3 = 210$ ). This lower ergogenic dose is approximately equivalent to 2 cups of brewed coffee consumed 30-60 minutes pre-exercise.
82. B — Carnosine buffers hydrogen ions during high-intensity exercise. This is most beneficial for 1-4 minute activities where glycolytic  $H^+$  accumulation is the primary performance limiter.
83. C — NSF Certified for Sport and Informed Sport independently test for banned substances, verify labels, and screen for contaminants. These provide the most reliable protection against inadvertent positive tests.

84. A — During deficit, protein needs increase to 2.0-2.4 g/kg/day to maximize lean mass preservation. Elevated protein with maintained resistance training provides the strongest defense against muscle catabolism.
85. D — Sodium bicarbonate increases the blood-to-muscle pH gradient, facilitating greater hydrogen ion efflux from working muscles. This delays the intramuscular acidosis that impairs cross-bridge function and causes fatigue.
86. B — A 75 kg athlete at 10 g/kg/day requires 750 grams daily ( $75 \times 10 = 750$ ). This supports extreme glycogen demands of high-volume endurance training.
87. C — Vitamin D deficiency produces impaired muscle function, compromised immune competence, and elevated stress fracture risk with decreased BMD. Athletes indoors or at northern latitudes are at greatest risk.
88. A — Vitamin C converts ferric iron ( $\text{Fe}^{3+}$ ) to the more bioavailable ferrous form ( $\text{Fe}^{2+}$ ), enhancing intestinal absorption of non-heme iron from plant-based sources.
89. D — When rapid recovery is needed (two sessions within 8 hours), 1.0-1.5 g/kg within 30 minutes capitalizes on maximal glycogen synthase activity. This enzyme is most active immediately post-exercise.
90. B — Complementary plant sources throughout the day provide all essential amino acids. Grains compensate for legumes' lysine limitation; legumes compensate for grains' methionine limitation.
91. C — Casein forms a stomach gel slowing digestion, providing sustained amino acid delivery throughout the 7-9 hour overnight fast. This supports muscle protein synthesis during sleep when no other protein is consumed.
92. A — High-GI foods are most appropriate during and immediately after exercise when rapid glucose delivery and glycogen replenishment are priorities. Fast absorption matches peri-exercise metabolic needs.
93. D — Glutamine has limited evidence for muscle growth in healthy, well-nourished athletes. It is not classified among supplements with robust ergogenic evidence (creatine, caffeine, beta-alanine, sodium bicarbonate).
94. B — Fat is essential for steroid hormones (cholesterol is the testosterone precursor), fat-soluble vitamins (A, D, E, K), cell membranes (phospholipid bilayer), and essential fatty acids (linoleic, alpha-linolenic) the body cannot synthesize.
95. C — Fluid intake of 200-300 mL every 15-20 minutes prevents body weight loss exceeding 2%, where impairments become measurable. Individual sweat rate and conditions should personalize the strategy.

## **SECTION 2 — PRACTICAL/APPLIED**

## EXERCISE TECHNIQUE (Questions 96–140)

96. A — Before loading, each novice should demonstrate a bodyweight squat assessing ankle, hip, and thoracic mobility plus knee tracking and spinal neutrality. This screening identifies restrictions requiring correction before external load.
97. D — Heels rising indicates insufficient ankle dorsiflexion — the tibia cannot translate forward adequately for balance with heels grounded. Ankle mobility work or heel-elevated shoes address this limitation.
98. B — Forward bar drift increases the horizontal distance from bar to lumbar spine, creating a larger moment arm. This dramatically amplifies flexion torque and lumbar injury risk.
99. C — An open grip allows the bar to roll onto the chest, neck, or face — potentially catastrophic. A closed grip with wrapped thumbs creates a mechanical lock preventing uncontrolled displacement.
100. A — Excessive lumbar hyperextension creates compressive and shear forces on the spine while shifting toward an incline press pattern. This indicates the load exceeds strict pressing capacity.
101. D — The NSCA top-down progression begins with the front squat — establishing the rack position, bar comfort on deltoids, and receiving posture before any pulling mechanics are introduced.
102. B — Premature arm bending substitutes arm strength for powerful hip extensors. Arms stay straight during the second pull, transmitting triple extension force. Pulling with arms limits velocity and cleanable weight.
103. C — Novice athletes begin with low-to-moderate intensity (squat jumps, CMJ, box jumps stepping down) at 80-100 foot contacts. High-intensity exercises require progressive connective tissue conditioning.
104. A — A single spotter positions behind with arms under the armpits, assisting at the torso. Never grip the bar — this creates asymmetric loading. Torso support safely assists upward.
105. D — The Valsalva is appropriate for healthy, trained athletes performing heavy compounds where maximal intra-abdominal pressure provides essential spinal stabilization. Contraindicated for cardiovascular risk.
106. B — Spinal rounding with momentum indicates excessive load and dangerous technique. Terminate, reduce load, cue rigid spinal neutrality with scapular retraction initiating the pull.
107. C — Pitchers need rotational power (medicine ball throws) for throwing and anti-rotation stability (Pallof press) for deceleration and spinal protection. Both demands are addressed.
108. A — Anti-extension exercises resist lumbar hyperextension as gravity pulls the spine into extension. The anterior core maintains neutrality against this extending force.

109. D — Running upright directs forces too vertically, reducing horizontal GRF needed to overcome inertia. Forward lean allows horizontal force application for acceleration.
110. B — The pro agility uses a preplanned pattern. True agility requires reactive perceptual-cognitive decision-making — responding to unpredictable stimuli while executing direction changes.
111. C — Dynamic stretching increases ROM while activating the neuromuscular system. Static stretching before explosive activity acutely reduces force and power through decreased stiffness and neural activation.
112. A — Foam rolling provides ROM improvements without acute force and power decrements associated with static stretching. This preserves neuromuscular readiness for explosive performance.
113. D — Correct sequence: general warmup → dynamic stretching → movement preparation → specific warmup with progressive loading. This general-to-specific progression optimizes readiness.
114. B — Chronic CWI may blunt inflammatory signaling necessary for hypertrophy and strength adaptation. Acute post-training inflammation is part of the adaptive cascade — chronically suppressing it impairs gains.
115. C — Sleep (7-10 hours) and post-exercise nutrition (protein for repair, carbohydrate for glycogen) are foundational. No external modality compensates for deficits in these biological requirements.
116. A — Basketball demands require aerobic base (48-minute sustained play), anaerobic intervals (court-length sprints), and reactive agility (direction changes responding to unpredictable game situations).
117. D — The aerobic system's primary team sport contribution is recovery — replenishing PCr, clearing metabolic byproducts, and restoring homeostasis between high-intensity bouts for sustained performance.
118. B — A wide receiver with 3-5 second sprints and 25-40 second rest operates at 1:5 to 1:8, targeting the phosphagen system with near-complete PCr recovery.
119. C — Tempo running at lactate threshold trains the body to sustain higher intensities before lactate exceeds clearance. This raises the threshold to a higher percentage of VO<sub>2</sub>max.
120. A — Active recovery promotes blood flow to recovering tissues, facilitating nutrient and oxygen delivery while assisting metabolic waste removal. This circulatory benefit is the primary mechanism.
121. D — Dropped elbows cause the bar to roll forward off the deltoids, creating loss of control, excessive wrist/elbow stress, and forward center of gravity shift. High elbows are essential.

122. B — Stepping backward eliminates the eccentric deceleration demand on the front leg. The front leg stays stationary with a vertical shin, reducing anterior knee shear forces.
123. C — Moving the front foot further creates a vertical shin, reducing forward knee translation. This shifts loading from knee extensors to hip extensors, decreasing anterior knee stress.
124. A — The hex bar centers load at the sides, reducing horizontal distance to the lumbar spine. The shorter moment arm decreases flexion torque and overall spinal loading.
125. D — Dumbbell spotting occurs at the wrists near the hands. Elbows create a fulcrum; dumbbells move independently. Wrist contact allows effective directional guidance.
126. B — Bands provide maximum resistance at the top (fully stretched) where free weights become easy. This trains force production through lockout in the strongest position.
127. D — Plyometric classification requires maximal speed with minimal catch-to-throw transition to exploit the SSC. Rapid execution stores and returns elastic energy and activates the stretch reflex.
128. A — Olympic platforms require separation from traffic with adequate clearance for dropped barbells. Safety clearance is the primary positioning consideration.
129. A — Groups of 3 per rack create efficient squat-spot-rest rotation. This maintains continuous workflow, ensures dedicated spotters, and keeps all athletes engaged.
130. B — Collars prevent plates from sliding off during exercise. Without them, plates can shift causing asymmetric loading, loss of control, and injury.
131. C — Power snatches are the explosive exercise requiring highest neuromuscular coordination, performed first when fresh. Remaining exercises follow the standard hierarchy.
132. A — Single bench spotter uses alternated grip (one pronated, one supinated) close to center for maximum security and symmetric upward force application.
133. A — An athlete explosive on field but struggling with heavy lifts has a strength deficit. Heavy training (85%+ 1RM) builds the force foundation supporting greater explosive output.
134. B — Slight constant knee flexion, neutral spine, hip hinge, bar close to legs represent correct RDL technique targeting hamstrings and glutes through eccentric hip flexion.
135. C — Pull-ups develop pulling strength for the stroke. Internal/external rotation protects the rotator cuff. Core anti-rotation develops trunk stability for force transfer.
136. A — The Pallof press resists rotational force — an external load attempts to twist the torso while the athlete maintains neutral alignment for spinal protection.
137. D — The snatch requires overhead reception in a deep squat. Overhead squat mobility verifies stable locked-arm position while squatting to full depth with upright torso.

138. B — Correct push-up: straight line head to heels, core braced, chest touches floor, elbows at approximately 45 degrees. This maximizes stimulus while protecting the shoulder.
139. C — Sprint intervals of 5-10 yards with 25-40 seconds rest replicate the lineman's phosphagen-dominant demands at the sport-specific work-to-rest ratio.
140. A — Face pulls at face height with external rotation and scapular retraction target posterior deltoids, infraspinatus, teres minor, and middle trapezius for shoulder health.

### **PROGRAM DESIGN (Questions 141–184)**

141. D — The 1500 meters (3:30-4:15) relies primarily on the aerobic system (~60-70%) supplemented by the glycolytic system (~25-35%) and the phosphagen system for the final kick. All three contribute at different race phases.
142. B — The push jerk is structural (loads the spine), performed explosively (rapid dip-drive with overhead receiving), and involves multiple large muscle groups. It meets all power exercise criteria.
143. C — The hang clean is the power/explosive exercise requiring highest neuromuscular coordination, performed first when fresh. Remaining exercises follow the standard NSCA hierarchy.
144. A — Novice athletes benefit from 2-3 total-body sessions per week with moderate loads (60-70% 1RM), higher repetitions (10-15), and technique emphasis. This provides adequate stimulus with sufficient recovery.
145. D — Loads >85% 1RM for  $\leq 6$  reps with 2-5 minutes rest develop maximal strength through neural adaptations: increased motor unit recruitment, improved rate coding, and enhanced intermuscular coordination.
146. B —  $85\% \text{ of } 165 = 140.25$ , rounded to approximately 140 kg per set. Five sets of 4 at this load with 3-minute rest is a heavy strength protocol targeting neural adaptation.
147. C — Rest of 30-90 seconds maintains elevated metabolic stress (lactate,  $H^+$ ) and the hormonal environment (GH, testosterone) supporting the growth stimulus through incomplete recovery.
148. A — DUP provides more frequent exposure to different stimuli within each week. Cycling through hypertrophy, strength, and power prevents accommodation and enables simultaneous multi-quality development.
149. D — Linear periodization progressively increases intensity while decreasing volume across mesocycles: high-volume/moderate-intensity  $\rightarrow$  moderate-volume/high-intensity  $\rightarrow$  low-volume/very-high-intensity peaking.

150. B — Block periodization: accumulation (high volume, moderate intensity) → transmutation (higher intensity, sport-specific) → realization (low volume, peaking). Each block builds on prior adaptations.
151. C — Maintaining intensity while reducing volume and frequency preserves the neural and muscular stimulus for strength maintenance. Intensity is the most critical detraining-prevention variable.
152. A — The transition provides 2-4 weeks of unstructured, low-intensity active recovery for physical/psychological restoration, injury treatment, and motivation renewal before the next cycle.
153. D — Jump squat peak power occurs at 0-30% of 1RM where lighter loading allows high velocity to maximize the velocity component of the power equation.
154. B — The hang clean achieves peak power at 70-80% of 1RM because sufficient mass is needed for meaningful force production while the ballistic nature maintains velocity high enough for peak power.
155. C — Beginners start with 80-100 foot contacts per session across varying intensity. This provides initial stimulus while protecting musculotendinous structures not yet conditioned for plyometrics.
156. A — Plyometrics follow warmup when fresh for maximal effort and technique. Fatigue from prior exercise degrades explosive output and landing mechanics.
157. D — High squat (90th) with low jump (28th) indicates a rate of force development deficit. Adequate strength but poor rapid expression requires explosive training (plyometrics, Olympic lifts, jump squats).
158. B — Soccer's 90-minute mixed demands require aerobic base (sustained play), anaerobic intervals (repeated sprints), and reactive agility (direction changes responding to opponents).
159. C — The transition provides 2-4 weeks of physical and psychological recovery, injury treatment, and motivation restoration through unstructured low-intensity activity.
160. A — Return to play requires bilateral symmetry within 10%, sport-specific movement competency, and medical clearance. Objective criteria reduce reinjury risk from persistent asymmetries.
161. D — Hockey shifts of 45-60 seconds with 2-3 minute rest are glycolytic-dominant. Matching interval training develops sport-specific glycolytic capacity for maximum transfer.
162. B — An advanced athlete preparing for a single competition requires block periodization. Accumulation → transmutation → realization provides precise control targeted for peak performance.
163. C — Accommodation predicts diminished response to constant stimulus. Variation in exercises, loads, volumes, or periodization provides novel stimuli overcoming the plateau.

164. A — Hamstring reconditioning progresses from low-intensity through sport-specific movements, meeting bilateral symmetry (within 10%) before unrestricted return.
165. D — Block periodization: accumulation (high volume/moderate intensity) → transmutation (higher intensity/sport-specific) → realization (low volume/peaking).
166. B — Muscular endurance uses 30 seconds or less rest to maintain elevated metabolic demand. Short rest prevents full recovery, forcing sustained work under fatigue.
167. C — Five sets of 2 at 93% with 5-minute rest develops maximal strength through neural adaptation. Near-maximal loading with complete recovery ensures maximal force on every repetition.
168. A — Volume load =  $5 \times 5 \times 135 = 3,375$  kg. Standard calculation for quantifying training work and tracking progressive overload.
169. D — Novice athletes use moderate loads (60-70% 1RM) with higher reps (10-15) for the first 4-6 weeks. This develops technique, work capacity, and connective tissue adaptation.
170. B — The 48-72 hour requirement allows adequate recovery of musculotendinous structures experiencing significant eccentric loading. Tendons adapt slower than muscle and require longer recovery.
171. C — Progressive intensity increases (70% → 78% → 83% → 89%) with volume decreases (4×8 → 4×6 → 4×5 → 4×3) across phases characterizes linear periodization.
172. A — Combining heavy training (85%+) with explosive exercises (Olympic lifts, plyometrics, jump squats at 30-50%) addresses both force-velocity ends.
173. D — The deload manages accumulated fatigue while maintaining neuromuscular stimulus through preserved intensity. Volume reduction allows recovery and supercompensation before the next loading cycle.
174. B — Rowing-specific conditioning for endurance, rows/pull-ups for pulling, anti-extension/anti-rotation core for stability, and front squats/RDLs for lower body drive address all needs.
175. C — Three-minute fighting rounds fall within the glycolytic-dominant range. Glycolysis provides primary ATP during each round, supplemented by phosphagen for explosive techniques and aerobic for between-round recovery.
176. A — Training intensity (% 1RM) is the most critical detraining-prevention variable. Volume and frequency can be substantially reduced while maintained intensity preserves adaptations.
177. D — Correct annual sequence: general preparation → specific preparation → competition → transition. Each period builds upon the preceding one.
178. B — Four sets of 12 at 70% with 60-second rest is a hypertrophy protocol. Moderate loading provides mechanical tension, higher reps and short rest create metabolic stress driving growth.

- 179. C — A decathlete's diverse events require concurrent training with undulating periodization addressing sprint speed, endurance, jumping power, throwing power, and skills simultaneously.
- 180. A — Belt squats, leg press, goblet squats with modified grip bypass barbell grip while maintaining lower body training. Eliminating all training causes unnecessary detraining.
- 181. D — A goalkeeper's explosive saves (2-5 seconds) are phosphagen-dominant. Work-to-rest of 1:8 to 1:12 allows near-complete PCr recovery between explosive efforts.
- 182. B — General preparation builds a broad base of hypertrophy, strength, work capacity, and aerobic fitness. This foundation supports subsequent specific, intense training.
- 183. C — Specific preparation shifts to sport-specific power, speed, agility, and conditioning. Methods replicate competitive demands identified in the needs analysis.
- 184. A — DUP provides frequent exposure to different stimuli within each week, preventing accommodation and enabling simultaneous multi-quality development.

#### **TESTING AND EVALUATION (Questions 185–206)**

- 185. D — The vertical jump using a Vertec is valid, reliable, practical for 50 athletes in 2 hours, and directly measures lower body explosive power.
- 186. B — Reliability is consistency and reproducibility ensuring observed changes reflect true performance improvement rather than measurement variability.
- 187. C — The 1RM is the last weight successfully lifted with proper technique through full ROM. Completed 145 kg, failed 150 kg — record 145 kg.
- 188. A — The 12 cm CMJ-SJ difference reflects SSC utilization — stored elastic energy and stretch reflex from the countermovement enhancing concentric force production.
- 189. D — The beep test requires only cones and sound system, administered to groups, providing valid aerobic capacity estimates with externally paced progressive intensity.
- 190. B — Two-step calculation: skinfolds enter prediction equations for body density, then body density converts to body fat percentage using the Siri formula.
- 191. C — BIA accuracy is most affected by hydration status, which alters electrical conductivity. Dehydration overestimates fat; hyperhydration underestimates it.
- 192. A — Electronic timing eliminates human timer reaction variability (0.1-0.3 seconds) — a substantial proportion of total sprint time obscuring real performance differences.
- 193. D — A 20% asymmetry exceeds the 10-15% threshold, warranting corrective programming and possible medical evaluation for underlying pathology.

194. B — The vertical jump (30th percentile) is disproportionately low relative to the 86th percentile squat, indicating a rate of force development deficit requiring explosive training.
195. C — Identical conditions across sessions — same warmup, equipment, test order, time, environment — is the most critical factor for valid longitudinal comparisons.
196. A — At 86%, the surgical leg hasn't met the 90% threshold. Continued progressive strengthening is needed because the persistent asymmetry increases reinjury risk.
197. C — Force plates measure peak GRF, rate of force development, impulse, and power output in addition to jump height — comprehensive data impossible with simpler methods.
198. B — The sit-and-reach primarily measures hamstring and lower back flexibility, doesn't assess other joints, and is influenced by limb proportions.
199. C — Goniometry provides joint-specific ROM measurements at any joint, identifying specific restrictions the sit-and-reach cannot detect.
200. A — Testing at the beginning and end of each major phase and at pre/post-season provides sufficient data for tracking and evaluation without excessive disruption.
201. D — Prediction equations are most accurate with 10 or fewer reps. The rep-to-1RM relationship becomes less linear at higher counts, introducing greater error.
202. A — The protocol includes 3-4 progressively heavier warmup sets (approximately 50%, 70%, 80-85% of estimated 1RM) before maximal attempts.
203. C — The T-test includes forward sprint, lateral shuffle both directions, and backward run in a T-shaped pattern assessing multidirectional movement.
204. D — A squat at  $1.1 \times$  body weight falls below the  $1.5 \times$  threshold for plyometric effectiveness. Heavy resistance training develops the strength base needed for power gains.
205. C — Both depend on self-pacing at maximal effort, influenced by motivation and pacing experience. Unfamiliar athletes may underestimate true aerobic capacity.
206. B — A comprehensive basketball battery assesses aerobic capacity, sprint speed, agility, lower body power, upper body strength, and body composition — matching the sport's diverse demands.

#### **ORGANIZATION AND ADMINISTRATION (Questions 207–220)**

207. C — NSCA minimum:  $50 \times 40 = 2,000$  sq ft. Upper guideline:  $50 \times 60 = 3,000$  sq ft. The minimum is 2,000 square feet.
208. A — EAPs should be rehearsed at least annually with all staff, ideally more frequently. Unrehearsed plans fail under emergency stress.

209. D — CPR and AED certification ensures immediate life-saving capability for cardiac emergencies. Survival declines approximately 10% per minute without intervention.
210. B — The standard of care is the degree of care a reasonably competent professional with similar training would exercise under similar circumstances — the minimum expected competence.
211. D — Waivers do not protect against willful misconduct or reckless conduct — safety disregard beyond ordinary carelessness. Waivers document inherent risk disclosure but cannot absolve reckless behavior.
212. A — Diagnosis and rehabilitation prescription are outside the CSCS scope. Refer to a physician, athletic trainer, or physical therapist for appropriate evaluation.
213. D — The CSCS scope encompasses designing programs, teaching technique, administering tests, and managing the facility. Diagnosis, rehabilitation, meal planning, and counseling require separate credentials.
214. B — Damaged equipment must be immediately removed, tagged out of order, documented, and repaired or replaced before return. Continued use violates the duty to maintain safety.
215. C — The CSCS must decline unsafe practices, explain the evidence-based rationale, and advocate for athlete safety. The certified professional holds ultimate program responsibility.
216. A — Ratios adjust based on exercise complexity, athlete experience, and staff qualifications. These factors collectively determine appropriate supervision levels.
217. D — Records include training logs, testing data, waivers, medical clearances, equipment maintenance logs, and incident reports for programming and legal documentation.
218. B — Unqualified instruction of demanding exercises to inexperienced athletes creates significant safety and liability risk. Address the concern through professional channels immediately.
219. C — Footwear policies protect athletes from dropped weights. Open-toed sandals provide zero protection. The policy must be enforced — proper shoes required before training.
220. A — The NSCA establishes that the CSCS holds ultimate professional authority and responsibility for the design, implementation, and supervision of the strength and conditioning program.