

# PRACTICE EXAM 12: CSCS FULL-LENGTH SIMULATION

---

## SECTION 1 — SCIENTIFIC FOUNDATIONS

95 Questions | 1.5 Hours Recommended

### EXERCISE SCIENCE (Questions 1–52)

1. A muscle biopsy from a competitive 400-meter sprinter shows 30% Type I, 50% Type IIa, and 20% Type IIx. After 20 weeks of combined sprint and heavy resistance training, the most likely change is which of the following?

- A. Decreased Type IIx with increased Type IIa
- B. Increased Type IIx from conversion of Type I
- C. Complete elimination of all Type II fibers
- D. No measurable change in any fiber proportions

2. The sliding filament theory states that during contraction, the sarcomere shortens but individual filaments do not change length. Which sarcomere band remains constant in width during contraction?

- A. The I-band
- B. The H-zone
- C. The A-band
- D. All bands narrow proportionally

3. A novice lifter increases squat 1RM by 42% in 7 weeks with only 3% hypertrophy. An experienced lifter on the same program gains 3% strength with 10% hypertrophy. This difference demonstrates which principle?

- A. Experienced athletes always gain strength faster
- B. Neural adaptation dominates early; hypertrophy dominates later
- C. Hypertrophy always precedes neural adaptation
- D. Both athletes adapted through identical mechanisms

4. During excitation-contraction coupling, calcium binds to troponin C. This binding produces which immediate structural change?

- A. Myosin heads detach from actin binding sites
- B. ATP is hydrolyzed on the myosin head
- C. The sarcoplasmic reticulum releases additional calcium
- D. Tropomyosin shifts to expose myosin binding sites on actin

5. An athlete performs a maximal isometric mid-thigh pull. Peak force is 4,200 N at 190 ms. The average RFD is approximately which value?

- A. 4,200 N/s
- B. 798 N/s
- C. 22,105 N/s
- D. Cannot be calculated from force plate data

6. The Golgi tendon organ detects muscle tension and produces autogenic inhibition. Chronic heavy training modifies GTO function by producing which change?

- A. Reduced inhibition allowing greater voluntary force production

- B. Increased inhibition activating at lower thresholds
- C. Complete structural elimination of all GTOs
- D. No measurable change under any condition

7. An exercise physiologist records blood lactate during a graded test: 175W = 1.5 mmol/L, 225W = 2.0 mmol/L, 275W = 5.8 mmol/L, 300W = 10.1 mmol/L. The lactate threshold occurred at approximately which workload?

- A. 175 watts where the first measurement was taken
- B. 300 watts where the highest value was recorded
- C. Cannot be identified from progressive test data
- D. Between 225 and 275 watts

8. A 40-second all-out cycling sprint produces blood lactate of 16 mmol/L and progressive power decline. The dominant energy system is which of the following?

- A. Oxidative phosphorylation through fat metabolism
- B. Anaerobic glycolysis
- C. The phosphagen system exclusively for 40 seconds
- D. Beta-oxidation of intramuscular triglycerides

9. During a 4-hour ride at 60%  $\text{VO}_{2\text{max}}$ , RER decreases from 0.85 to 0.76. This shift indicates which metabolic change?

- A. Increased anaerobic glycolysis in the final hour
- B. Increased protein catabolism as the sole fuel
- C. Greater fat oxidation as glycogen depletes
- D. Decreased total metabolic activity

10. The electron transport chain requires oxygen as the final electron acceptor. Without oxygen, which consequence occurs?

- A. Aerobic ATP production ceases entirely
- B. The ETC continues at reduced capacity
- C. Fat oxidation increases to compensate
- D. The Krebs cycle accelerates to bypass the ETC

11. Fat oxidation produces more ATP per molecule than glucose but cannot fuel high-intensity exercise. The limiting factor is which of the following?

- A. Fat stores are too small for meaningful energy
- B. Fat cannot physically enter mitochondria
- C. Fat produces toxic byproducts at high intensities
- D. Fat produces ATP too slowly for high-intensity demands

12. A marathon runner's blood glucose drops to 47 mg/dL at mile 22. The primary cause of performance decline is which event?

- A. Phosphocreatine depletion from the aerobic effort
- B. Glycogen depletion and hypoglycemia
- C. Hydrogen ion accumulation from steady-state running
- D. Complete destruction of contractile protein tissue

13. During a graded exercise test,  $\text{VO}_2$  plateaus at 54 mL/kg/min despite two additional workload increases. RER is 1.16, HR is within 5 bpm of age-predicted max, and lactate is 12 mmol/L. This confirms which measure?

- A. The lactate threshold at 54 mL/kg/min

- B. The ventilatory threshold
- C.  $\text{VO}_2\text{max}$  at 54 mL/kg/min
- D. Resting metabolic rate

14. Stroke volume plateaus at approximately 40-60% of  $\text{VO}_2\text{max}$  during progressive exercise. Further cardiac output increases depend on which variable?

- A. Continued heart rate increases via sympathetic activation
- B. Continued ventricular enlargement during the test
- C. Decreased blood volume concentrating oxygen
- D. Increased blood viscosity forcing faster flow

15. An athlete produces 2,900 N of vertical GRF. Body weight is 784 N (80 kg). For upward acceleration, the net force must exceed which value?

- A. Only the barbell weight without body mass
- B. Zero Newtons for any upward movement
- C. The GRF must equal body weight exactly
- D. The net force ( $2,900 - 784 = 2,116$  N) drives acceleration

16. During a conventional deadlift, the sticking point near knee height exists because of which biomechanical factor?

- A. The quadriceps reach shortest length at knee height
- B. Maximum moment arm on the lumbar spine at this position
- C. Grip always fails at exactly knee height
- D. Gravitational force on the barbell triples at this position

17. The ventilatory threshold corresponds to increased CO<sub>2</sub> from which buffering process?
- A. Phosphocreatine breakdown releasing inorganic phosphate
  - B. Fat oxidation producing metabolic waste
  - C. Bicarbonate buffering of hydrogen ions from glycolysis
  - D. Protein deamination releasing ammonia
18. Peak muscular power occurs at approximately which region of the force-velocity curve?
- A. Maximum force at zero velocity
  - B. Maximum velocity at zero load
  - C. Power is equal at every point on the curve
  - D. 30-60% of maximal force with moderate-to-high velocity
19. An athlete's passive hip flexion is 138° and active is 116°. The 22° difference reflects which principle?
- A. Neuromuscular limits of voluntary effort versus external force capacity
  - B. A structural bone abnormality at the hip
  - C. A complete hip flexor rupture
  - D. Goniometer calibration error of exactly 22°
20. A trained endurance athlete has resting SV of 118 mL and HR of 44 bpm. Resting cardiac output is approximately which value?
- A. 118 mL/min
  - B. Approximately 5,192 mL/min
  - C. 44 mL/min

D. 10,384 mL/min

21. Blood flow redistribution during maximal exercise directs 80-85% of cardiac output to working muscles through which mechanism?

- A. Permanent vessel closure to the brain
- B. Decreased total cardiac output
- C. Increased blood viscosity forcing flow to muscles
- D. Local metabolic vasodilation plus sympathetic vasoconstriction

22. A protocol of 4×10 at 72% with 60-second rest produces greater GH than 5×2 at 93% with 5-minute rest. The primary GH stimulus is which factor?

- A. Heavier absolute loads in the volume protocol
- B. Greater total time in the strength protocol
- C. Higher metabolic stress from incomplete recovery
- D. Superior neural recruitment from lighter loads

23. Female athletes with 10-15× lower testosterone than males still gain significant strength primarily through which mechanism?

- A. Neural adaptations including recruitment and coordination
- B. Greater GH compensating for lower testosterone
- C. Flexibility directly increasing force production
- D. Bone density increases replacing hypertrophy

24. An athlete's T:C ratio declines for 8 weeks with stagnated performance, insomnia, and elevated resting HR. This indicates which condition?

- A. Optimal peaking for competition
- B. Overtraining syndrome
- C. Normal hormonal fluctuation
- D. Acute delayed-onset muscle soreness

25. Wolff's Law predicts the greatest osteogenic stimulus from which exercise type?

- A. Deep-water aquatic exercise with buoyancy
- B. Recumbent cycling at very low intensity
- C. Seated machine exercises with light loads
- D. Ground-based resistance with compressive and impact forces

26. Two athletes share a 195 kg squat 1RM. Athlete A jumps 72 cm; Athlete B jumps 54 cm. The 18 cm difference is best explained by which quality?

- A. Superior aerobic capacity in Athlete A
- B. Greater absolute strength in Athlete A
- C. Superior rate of force development in Athlete A
- D. Greater flexibility in Athlete A

27. During sprint acceleration, a forward lean allows GRF to be directed primarily in which direction?

- A. Horizontally to generate forward momentum
- B. Vertically to maximize flight time
- C. Mediolaterally for balance

D. No specific direction

28. At maximum sprint velocity, which GRF component most distinguishes faster from slower sprinters?

A. The anteroposterior component

B. The mediolateral component

C. All three equally

D. The vertical component

29. An athlete's CMJ is 68 cm and SJ is 55 cm. The 13 cm difference represents the contribution of which mechanism?

A. Greater phosphocreatine during CMJ

B. The stretch-shortening cycle

C. Enhanced aerobic energy during countermovement

D. Reduced bodyweight at the transition

30. Third-class levers in the human body favor which mechanical outcome?

A. Force amplification at the expense of speed

B. Equal force and speed at all angles

C. Speed and range of motion at the expense of force

D. Zero mechanical advantage

31. Connective tissue adapts more slowly than muscle because of which characteristic?

A. Lower metabolic activity and reduced blood supply

- B. Identical metabolic activity to muscle
- C. Higher metabolic rate than muscle
- D. No capacity for structural remodeling

32. The SAID principle predicts that slow jogging at 55% HRmax for a basketball player violates specificity because it fails to develop which demands?

- A. Only aerobic fitness is needed for basketball
- B. Slow jogging provides all basketball adaptations
- C. Only flexibility is relevant to basketball
- D. Explosive jumping, sprint speed, agility, and anaerobic capacity

33. Eccentric force exceeds concentric force by 20-60%. This supports which training application?

- A. Identical loading for all contraction types
- B. Supramaximal eccentric training with loads exceeding concentric 1RM
- C. Elimination of all eccentric training
- D. Eccentric actions produce zero force

34. Detraining research shows which quality declines most rapidly?

- A. Maximal strength within 24 hours
- B. Bone mineral density within 5 days
- C. Aerobic capacity within 1-2 weeks
- D. Flexibility permanently within 48 hours

35. The creatine kinase reaction produces ATP faster than any other system because of which characteristic?

- A. Single-step enzymatic reaction in the sarcoplasm requiring no oxygen
- B. Complex mitochondrial processing with multiple steps
- C. Exclusive operation within the mitochondrial matrix
- D. Oxygen required as essential co-factor

36. The "muscle memory" phenomenon is explained by which cellular mechanism?

- A. Elevated creatine kinase persisting indefinitely
- B. Residual glycogen lasting years after detraining
- C. Circulating testosterone remaining elevated forever
- D. Retained myonuclei from prior training persisting through atrophy

37. PNF contract-relax stretching increases ROM after isometric contraction because of which mechanism?

- A. Muscle spindle facilitation increasing contraction
- B. GTO autogenic inhibition reducing muscle tone
- C. Pacinian corpuscle vibration detection
- D. Ruffini ending pressure sensing

38. A dumbbell lateral raise: 8 kg at 90° abduction, 0.57 m from shoulder to dumbbell center. The torque is approximately which value?

- A. Approximately 44.7 N·m
- B. 8 N·m

- C. 0 N·m
- D. 200 N·m

39. Diastolic blood pressure remains stable during moderate exercise because of which mechanism?

- A. Vasoconstriction in all vascular beds
- B. Increased blood viscosity
- C. Vasodilation in working muscles reducing peripheral resistance
- D. Decreased cardiac output during diastole

40. Cortisol's acute catabolic actions during exercise serve which metabolic purpose?

- A. Stimulating protein synthesis via mTOR
- B. Enhancing glycogen synthesis in muscle
- C. Suppressing all lipolysis during exercise
- D. Protein degradation and gluconeogenesis for blood glucose maintenance

41. An athlete's post-16-week blood work shows stable testosterone, decreased cortisol, improved T:C ratio, continued performance gains, and adequate sleep. This indicates which status?

- A. Advanced overtraining syndrome
- B. Successful positive adaptation
- C. Underlying medical condition
- D. Irrelevant data

42. Chronic resistance training increases androgen receptor density. The practical significance is which of the following?

- A. Enhanced muscle sensitivity to circulating testosterone
- B. No effect on hormonal response
- C. Eliminates need for sleep and nutrition
- D. Reverses within 24 hours

43. The crossover concept describes which metabolic phenomenon?

- A. Transfer of training from one limb to the other
- B. Conversion of fast-twitch to slow-twitch fibers
- C. Progressive shift from fat to carbohydrate oxidation as intensity increases
- D. Transition from aerobic to anaerobic threshold

44. The Cori cycle recycles lactate to glucose through which organ?

- A. The kidneys
- B. The spleen
- C. The pancreas
- D. The liver

45. A female distance runner has amenorrhea for 9 months, intake of 1,100 kcal/day with 2.5 hours training, decreased lumbar BMD, and recent stress fractures. This indicates which condition?

- A. Iron deficiency anemia
- B. RED-S (Relative Energy Deficiency in Sport)
- C. Normal endurance training adaptation

D. Vitamin D toxicity

46. RED-S in male athletes produces which combination of consequences?

- A. Suppressed testosterone, decreased BMD, impaired immunity, declining performance
- B. Enhanced performance from metabolic efficiency
- C. Increased testosterone from adaptive restriction
- D. No consequences in males

47. The stretch reflex during plyometric landing is classified as which neural pathway type?

- A. Polysynaptic through the cerebral cortex
- B. Voluntary cortical contraction
- C. Monosynaptic — the fastest reflexive contraction
- D. Inhibitory reflex reducing force

48. An athlete performs depth jumps. Contact time increases from 165 ms to 350 ms by rep six with declining rebound height. The appropriate response is which of the following?

- A. Increase box height to force faster transitions
- B. Add ankle weights for greater eccentric load
- C. Continue to 15 reps for fatigue-based adaptation
- D. Terminate the exercise — SSC benefit is lost

49. Two athletes at 87 kg produce 3,000 N peak GRF. Athlete A reaches peak in 130 ms; Athlete B in 280 ms. Athlete A jumps higher because of which quality?

- A. Greater absolute strength

- B. Superior rate of force development
- C. Superior aerobic capacity
- D. Greater flexibility

50. During a depth jump, if amortization exceeds 250 ms, which consequence occurs?

- A. Elastic energy dissipates as heat and stretch reflex diminishes
- B. The stretch reflex is amplified
- C. Concentric force is enhanced
- D. Musculotendinous stiffness increases

51. The second-class lever of a calf raise favors which mechanical outcome?

- A. Speed and ROM at the expense of force
- B. Equal force and speed at all angles
- C. Force production because the effort arm exceeds the resistance arm
- D. Zero mechanical advantage

52. An athlete's accommodation plateau after 22 weeks on the same program is best addressed by which intervention?

- A. Continue the identical program indefinitely
- B. Complete cessation for 6 months
- C. Reduce all loads to 25% permanently
- D. Introduce variation in exercises, loads, or periodization

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

53. An athlete reports racing thoughts, worry about failure, and negative self-talk before competition. These are symptoms of which anxiety type?

- A. Somatic anxiety
- B. Cognitive anxiety
- C. Trait anxiety that cannot be modified
- D. Facilitative arousal

54. The inverted-U hypothesis predicts that a maximal deadlift benefits from which arousal level?

- A. Very low arousal for relaxation
- B. Moderate arousal identical to precision putting
- C. Irrelevant — arousal has no effect
- D. Relatively high arousal for maximal recruitment

55. The most effective goal-setting approach combines which three goal types?

- A. Only outcome goals without daily targets
- B. Only process goals without long-term direction
- C. Outcome, performance, and process goals hierarchically
- D. No goals because goal-setting reduces motivation

56. Self-efficacy is distinguished from general confidence by which characteristic?

- A. It is a global personality trait across all domains

- B. Determined exclusively by genetics
- C. Identical to general confidence
- D. Task-specific and situation-specific

57. An athlete watches a teammate of similar ability complete a challenging lift. The resulting confidence increase comes from which self-efficacy source?

- A. Past performance accomplishment
- B. Vicarious experience
- C. Verbal persuasion
- D. Physiological state interpretation

58. A coach says: "Your hips rose too fast during the pull." This feedback is classified as which type?

- A. Knowledge of performance about movement quality
- B. Knowledge of results about the outcome
- C. Intrinsic feedback from proprioception
- D. Motivational feedback to increase effort

59. Random practice compared to blocked practice produces which long-term learning outcome?

- A. Faster initial improvement and better retention
- B. Identical outcomes regardless of structure
- C. Slower initial improvement but better long-term retention
- D. Faster improvement with identical retention

60. The guidance hypothesis states feedback after every rep produces which long-term consequence?

- A. Optimal permanent learning
- B. Accelerated mastery persisting indefinitely
- C. No measurable effect
- D. Impaired learning from dependency on external correction

61. Distributed practice produces better long-term learning than massed practice through which mechanism?

- A. Elimination of all errors during practice
- B. Memory consolidation during rest intervals
- C. Massed practice produces zero learning
- D. Glycogen resynthesis improving cortical function

62. An athlete in Fitts and Posner's autonomous stage demonstrates which characteristics?

- A. Automatic execution with attention free for strategy
- B. Large errors with heavy reliance on verbal instruction
- C. Inability to perform the skill
- D. Conscious attention required for every repetition

63. Athletic burnout is characterized by which three dimensions?

- A. Increased motivation and energy
- B. Normal fluctuation resolving within hours
- C. Emotional exhaustion, depersonalization, and reduced accomplishment

D. Acute anxiety resolving after competition

64. A 16-year-old athlete shows isolation, worthlessness, lost interest, and expressed hopelessness. The specialist should do which of the following?

- A. Design more intense training for confidence
- B. Increase competitive schedule for success
- C. Ignore as normal adolescent development
- D. Recommend parents seek mental health evaluation

65. Self-determination theory identifies which three basic psychological needs?

- A. Strength, power, and endurance
- B. Autonomy, competence, and relatedness
- C. Visual, kinesthetic, and auditory processing
- D. Outcome, performance, and process achievement

66. A wrestler displays extreme weight manipulation, meal avoidance, excessive exercise, and weight preoccupation. The CSCS should do which of the following?

- A. Refer to a qualified healthcare professional
- B. Prescribe a corrective meal plan
- C. Increase body composition testing frequency
- D. Ignore as normal wrestling culture

67. When a pitcher throws a fastball then a changeup, which GMP parameter changes while invariant features remain constant?

- A. Relative timing of muscle activations
- B. Fundamental spatial pattern of the throw
- C. Overall speed and absolute force of execution
- D. Nothing — the GMP is permanently fixed

68. A point guard scanning the entire court uses which attentional focus in Nideffer's model?

- A. Narrow-internal
- B. Narrow-external
- C. Broad-internal
- D. Broad-external

69. An athlete consistently excels in practice but underperforms in competition with intense worry and negative self-talk. This indicates which phenomenon?

- A. Social facilitation enhancing performance
- B. Choking under pressure from excessive cognitive anxiety
- C. Optimal arousal producing best output
- D. A permanent disorder preventing competitive success

70. An ACL reconstruction patient fears re-injury during cutting drills despite full clearance. The best response is which of the following?

- A. Gradual reintroduction with sport psychology referral
- B. Immediate full-contact return

- C. Permanent elimination of all cutting
- D. Dismissal of psychological concerns

71. Research on injury psychology shows athletes with significant rehabilitation distress have which outcome?

- A. Faster recovery from motivational distress
- B. Identical outcomes to well-adjusted athletes
- C. Longer recovery and higher re-injury rates
- D. Improved mental toughness from the experience

72. Motor learning research shows reducing feedback to ~50% of trials produces which effect?

- A. Slower acquisition during practice
- B. Identical outcomes regardless of frequency
- C. Permanent impairment of all learning
- D. Better long-term retention through internal error detection

73. An athlete successfully squats 200 kg for the first time and reports increased confidence for 205 kg. Which self-efficacy source is responsible?

- A. Vicarious experience
- B. Past performance accomplishment
- C. Verbal persuasion
- D. Physiological state interpretation

74. Somatic anxiety symptoms are best addressed by which intervention?

- A. Physical relaxation techniques (PMR, diaphragmatic breathing)
- B. Thought stopping and cognitive restructuring
- C. Goal-setting worksheets
- D. Imagery of worst-case failure

75. Mental imagery is most effective when engaging which sensory modalities?

- A. Only visual with all others suppressed
- B. Only kinesthetic with no visual
- C. Visual, kinesthetic, auditory, and emotional simultaneously
- D. Only auditory sounds of competition

**NUTRITION (Questions 76–95)**

76. A 110 kg strength athlete at 2.2 g/kg/day requires which daily protein target?

- A. 88 grams
- B. 165 grams
- C. 550 grams
- D. 242 grams

77. Which amino acid is the primary trigger for mTOR activation?

- A. Glutamine
- B. Leucine

- C. Glycine
- D. Alanine

78. An athlete on <15% fat for 5 months has suppressed testosterone. The cause is which of the following?

- A. Inadequate fat impairing steroid hormone production
- B. Excessive protein causing renal stress
- C. Excessive carbohydrate causing insulin resistance
- D. Chronic dehydration mimicking hormone suppression

79. An athlete drinks 3 L/hr of plain water for 4 hours without sodium during a marathon. The resulting confusion is caused by which condition?

- A. Hypernatremia from sodium concentration
- B. Metabolic alkalosis
- C. Exercise-associated hyponatremia from sodium dilution
- D. Rhabdomyolysis

80. Creatine maintenance (3-5 g/day without loading) achieves full saturation in approximately how long?

- A. 24-48 hours
- B. Impossible without loading
- C. 6-12 months
- D. Approximately 28 days

81. Caffeine's primary ergogenic mechanism is which of the following?

- A. Directly increasing phosphocreatine stores
- B. Blocking adenosine receptors reducing fatigue perception
- C. Stimulating muscle protein synthesis
- D. Permanently increasing metabolic rate

82. Beta-alanine supplementation is most beneficial for activities lasting which duration?

- A. 1-4 minutes where glycolytic  $H^+$  limits performance
- B. Less than 5 seconds
- C. Longer than 60 minutes
- D. During complete rest

83. Which third-party certification minimizes WADA doping risk?

- A. USDA Organic
- B. FDA pharmaceutical approval
- C. NSF Certified for Sport or Informed Sport
- D. ISO 9001 manufacturing

84. For an athlete in caloric deficit, protein should be at which level to preserve lean mass?

- A. 0.8 g/kg general population RDA
- B. Less than 0.5 g/kg
- C. No protein during restriction
- D. 2.0-2.4 g/kg/day

85. Sodium bicarbonate's most common side effect limiting use is which of the following?

- A. Permanent liver damage
- B. GI distress including nausea, bloating, and diarrhea
- C. Dangerous cardiac arrhythmias
- D. Complete energy system suppression

86. A 72 kg endurance athlete at 10 g/kg/day requires which daily carbohydrate target?

- A. 720 grams
- B. 72 grams
- C. 360 grams
- D. 1,440 grams

87. Vitamin D deficiency consequences in athletes include which of the following?

- A. Excessive uncontrollable hypertrophy
- B. Enhanced performance from metabolic efficiency
- C. Impaired muscle function, compromised immunity, elevated stress fracture risk
- D. No consequences for any population

88. Vitamin C enhances non-heme iron absorption through which mechanism?

- A. Inhibiting all iron absorption
- B. No interaction with iron metabolism
- C. Enhancing heme iron while blocking non-heme
- D. Converting  $\text{Fe}^{3+}$  to more bioavailable  $\text{Fe}^{2+}$

89. When two sessions are within 8 hours, post-exercise carbohydrate within 30 minutes should be which amount?

- A. No carbohydrate for 12 hours
- B. 1.0-1.5 g/kg to maximize glycogen synthase activity
- C. 0.1 g/kg to minimize insulin
- D. Only protein with zero carbohydrate

90. Plant-based athletes achieve adequate amino acids through which strategy?

- A. Complementary plant sources throughout the day
- B. Plant diets cannot provide adequate protein
- C. Only soy protein at every meal
- D. 100 grams isolated BCAAs daily

91. Casein before sleep supports recovery through which mechanism?

- A. Immediate emptying identical to whey
- B. Complete catabolic suppression for 48 hours
- C. Slow gel-forming digestion providing sustained amino acid delivery
- D. No benefit — pre-sleep protein is wasted

92. High-GI foods are most appropriately consumed at which time?

- A. Only at breakfast
- B. Exclusively before sleep
- C. Never by any athlete

D. During and immediately after exercise

93. Glutamine's evidence for muscle growth in well-nourished athletes is best described as which of the following?

- A. Strongest evidence of any supplement
- B. Limited — not classified among robust ergogenic aids
- C. Permanently elevates testosterone
- D. Only supplement approved by all agencies

94. Adequate dietary fat (20-35% calories) serves which essential functions?

- A. Hormone production, vitamin absorption, membrane integrity, essential fatty acids
- B. No physiological function
- C. Exclusive phosphagen fuel during sprinting
- D. Direct Type IIx hyperplasia stimulation

95. General fluid intake during 90-minute team sport should be which of the following?

- A. No fluid because drinking impairs performance
- B. 4 liters at halftime
- C. 200-300 mL every 15-20 minutes adjusted for sweat rate
- D. Only caffeinated beverages

## **SECTION 2 — PRACTICAL/APPLIED**

**125 Questions | 2.5 Hours Recommended**

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

96. An athlete performing the back squat exhibits a lateral weight shift, dropping one hip lower than the other during the descent. This compensation most commonly indicates which underlying issue?

- A. Excessive bilateral hip mobility
- B. Superior quadriceps strength bilaterally
- C. Normal squat mechanics requiring no correction
- D. Unilateral hip mobility restriction or strength asymmetry

97. During a barbell overhead press, an athlete flares the rib cage excessively at the bottom of the press. This compensatory pattern bypasses which stabilizing muscle group?

- A. The posterior deltoids
- B. The anterior core musculature maintaining rib-pelvis alignment
- C. The biceps brachii
- D. The ankle dorsiflexors

98. An athlete performing pull-ups fails to achieve full elbow extension at the bottom of each rep, stopping approximately 20° short. This partial ROM reduces the training stimulus to which portion of the movement?

- A. The initial pull from the fully lengthened position activating the lats at long muscle length
- B. The peak contraction at the top of the pull
- C. The eccentric lowering phase exclusively
- D. No portion is affected by the reduced ROM

99. A strength and conditioning specialist observes an athlete performing split squats with the front shin angled backward (negative shin angle). This position shifts loading emphasis to which muscle group?

- A. The anterior tibialis and dorsiflexors
- B. The latissimus dorsi
- C. The hip extensors (glutes) rather than the quadriceps
- D. The rotator cuff musculature

100. During the barbell hip thrust, an athlete positions the bar too far above the hip crease, resting it on the lower abdomen. This bar placement creates which primary concern?

- A. Enhanced glute activation from the higher position
- B. Improved core engagement from abdominal pressure
- C. No safety or comfort concern
- D. Pressure on the abdominal organs and reduced mechanical advantage for hip extension

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

- A. Full squat clean from the floor at heavy loads
- B. The front squat establishing the receiving position
- C. The hang clean at challenging loads
- D. Clean pulls from the floor without catching

102. When spotting dumbbell exercises, the spotter applies assistance at which location?

- A. At the wrists near the athlete's hands
- B. Directly on the dumbbells themselves
- C. At the elbows for leverage

D. At the upper arms near the shoulders

103. A strength and conditioning specialist programs the first plyometric session for athletes with no prior plyometric experience but 12 weeks of resistance training. The appropriate prescription is which of the following?

- A. Depth jumps from 42-inch boxes at 250 foot contacts
- B. Single-leg depth jumps with weighted vests
- C. Low-to-moderate intensity exercises at 80-100 foot contacts
- D. Weighted jump squats at 60% 1RM for 300 contacts

104. Proper breathing during heavy compound lifts involves which technique for trained athletes performing near-maximal loads?

- A. Continuous exhaling throughout both phases
- B. Inhaling during the concentric exertion phase
- C. No structured breathing pattern is necessary
- D. Valsalva maneuver creating intra-abdominal pressure for spinal stabilization

105. An athlete performing barbell bent-over rows uses excessive body momentum and rounds the spine. The corrective coaching sequence is which of the following?

- A. Encourage momentum for heavier loading
- B. Terminate set, reduce load, cue neutral spine with scapular retraction before elbow flexion
- C. Add more weight to challenge the posterior chain further
- D. Switch permanently — rows cannot be performed safely

106. A strength and conditioning specialist programs single-arm dumbbell rows for a baseball player. This unilateral exercise selection addresses which sport-specific demand?

- A. Anti-rotation core stability and unilateral pulling strength matching throwing demands
- B. Bilateral pressing power for batting
- C. Bilateral squat strength for base running
- D. Aerobic endurance for 9-inning game duration

107. An athlete performing box jumps lands on the box with a loud, flat-footed impact and minimal knee flexion. This landing technique creates which primary concern?

- A. Enhanced force production from rigid landing
- B. Improved ankle stiffness for subsequent jumps
- C. Excessive impact forces through the joints from inadequate force absorption
- D. No safety concern with this landing pattern

108. A strength and conditioning specialist includes Nordic hamstring curls in a sprinter's program. This exercise targets which specific injury risk?

- A. Rotator cuff impingement during arm swing
- B. Lumbar disc herniation during block starts
- C. ACL tear during change-of-direction movements
- D. Hamstring strain during the late swing phase of sprinting

109. During the power snatch, an athlete catches the bar with the elbows bent rather than locked. This error creates which immediate concern?

- A. Enhanced shoulder stability from the bent position

- B. Unstable receiving position with risk of losing the bar forward or backward
- C. Improved force transmission to the overhead position
- D. No concern because bent elbows are acceptable technique

110. An athlete performing cable woodchops rotates primarily through the lumbar spine rather than the thoracic spine and hips. This movement pattern creates which concern?

- A. Excessive lumbar rotational stress increasing disc injury risk
- B. Enhanced core activation from lumbar rotation
- C. Improved rotational power development
- D. No concern because lumbar rotation is the intended pattern

111. A strength and conditioning specialist programs tempo front squats (3-second eccentric, 2-second pause in the bottom) for a novice athlete. The primary purpose of the tempo prescription is which of the following?

- A. Maximum power through high-velocity execution
- B. Aerobic endurance through extended set duration
- C. Time under tension for hypertrophy and positional awareness at the most challenging range
- D. Flexibility through loaded stretching

112. During a barbell hip hinge, an athlete's knees slide forward excessively, turning the RDL into a squat pattern. The coaching cue to correct this is which of the following?

- A. Increase knee flexion further beyond 90°
- B. Look straight down at the floor
- C. Round the spine to shift the hips back
- D. "Push your hips straight back" to maintain the hinge with minimal forward knee travel

113. A strength and conditioning specialist includes farmer's walks as a primary core training method. This exercise develops which combination of qualities?

- A. Isolated rectus abdominis hypertrophy for sit-up testing
- B. Grip endurance, core stability, and postural strength under load
- C. Maximum rotational power for throwing sports
- D. Spinal flexion range of motion improvement

114. An athlete performing seated cable rows demonstrates forward head posture and rounded shoulders at the end range. This indicates insufficient activation of which muscles?

- A. The scapular retractors (middle trapezius and rhomboids) and cervical extensors
- B. The pectoralis major and anterior deltoid
- C. The quadriceps and hip flexors
- D. The biceps brachii and brachioradialis

115. A strength and conditioning specialist programs landmine presses for an athlete with limited overhead mobility. This modification provides which advantage?

- A. Identical overhead demands to a barbell strict press
- B. Exclusive lower body loading with no pressing component
- C. An angled pressing path that trains the pattern without full overhead ROM
- D. Isolated rotator cuff work without deltoid engagement

116. Kettlebell swings are classified as a hip hinge. The primary force generators are which muscle groups?

- A. The arms and anterior deltoids through shoulder flexion

- B. The quadriceps through knee extension
- C. The lumbar erectors through spinal hyperextension
- D. The hip extensors (glutes and hamstrings) through explosive hip extension

117. An athlete performing dips demonstrates excessive forward lean. This position shifts training emphasis from triceps toward which muscle?

- A. The quadriceps
- B. The pectoralis major
- C. The posterior deltoids
- D. The hamstrings

118. Band-resisted sprints primarily develop which quality?

- A. Overloaded horizontal force production during acceleration
- B. Aerobic endurance through sustained running
- C. Hip flexor flexibility during sprinting
- D. Reduced joint impact forces

119. Proper box jump landing mechanics require which combination of standards?

- A. Stiff-legged landing with locked knees
- B. Landing on the heels with trunk flexed forward
- C. Soft landing with hip and knee flexion, neutral spine, and knees tracking over toes
- D. Single-leg landing with opposite leg extended

120. A strength and conditioning specialist programs sled pushes for a football lineman. This exercise develops which sport-specific quality?

- A. Overhead pressing strength for pass blocking
- B. Vertical jumping power for contested catches
- C. Aerobic endurance for sustained low-intensity play
- D. Horizontal force production and acceleration mechanics matching blocking demands

121. During barbell back squats, an athlete's knees consistently collapse inward (valgus) during the ascent. This fault indicates weakness in which muscle group?

- A. The hip flexors and rectus femoris
- B. The hip abductors and external rotators (gluteus medius)
- C. The ankle plantarflexors
- D. The anterior deltoids

122. A reverse lunge reduces anterior knee stress compared to forward lunges because of which biomechanical factor?

- A. Elimination of front-leg eccentric deceleration demand
- B. Greater patellofemoral compression
- C. Increased forward knee translation
- D. Elimination of all eccentric action

123. The hex bar deadlift provides which advantage over the conventional deadlift?

- A. Greater lumbar moment arm for back strengthening
- B. Identical biomechanics with no difference

- C. Reduced lumbar moment arm from load centered closer to the body
- D. Increased grip demand from thicker handles

124. Resistance bands on a barbell squat provide maximum resistance at which position?

- A. The bottom where the band is least stretched
- B. Constant throughout the ROM
- C. The bottom where the athlete is weakest
- D. The top where the band is fully stretched and the athlete is strongest

125. A medicine ball rotational throw qualifies as plyometric only when performed with which characteristic?

- A. 5-second isometric pause between catch and throw
- B. Maximal speed with minimal eccentric-to-concentric transition
- C. Slow controlled tempo for time under tension
- D. Maximum weight regardless of execution speed

126. Olympic lifting platforms should be positioned with which primary consideration?

- A. Separated from traffic with adequate clearance for dropped barbells
- B. Against mirrors for technique monitoring
- C. Adjacent to cardio equipment for circuits
- D. Center of facility for motivational atmosphere

127. A specialist trains 30 athletes with 10 racks. The optimal approach is which of the following?

- A. All 30 doing bodyweight squats while waiting
- B. All 30 watching one demonstration the entire session
- C. Groups of 3 per rack rotating squat, spot, and rest
- D. Eliminating squats from the program

128. Barbell collars serve which primary safety purpose?

- A. Increasing total barbell weight
- B. Improving grip friction on the bar
- C. Decorative with no function
- D. Preventing plates from sliding off during exercise

129. An athlete's program includes power snatches, front squats, bench press, cable rows, lateral raises, and planks. Which exercise is performed first?

- A. Planks for core pre-activation
- B. Power snatches — explosive exercise performed when freshest
- C. Lateral raises as isolation before compounds
- D. Cable rows as pulling before pressing

130. The recommended single-spotter bench press grip is which of the following?

- A. Alternated grip close to center for security and symmetric force
- B. Wide pronated grip matching athlete's width
- C. No grip — hands on athlete's elbows

D. Supinated grip near the weight plates

131. An athlete explosive on field but struggling with heavy lifts has which deficiency?

- A. Excessive explosive ability beyond development
- B. Only aerobic conditioning needed
- C. Maximal strength deficit requiring heavy training (85%+ 1RM)
- D. Only flexibility training needed

132. Correct RDL technique includes which combination of standards?

- A. Full knee lockout with lumbar rounding
- B. Deep knee flexion in a squat pattern
- C. Alternating knee extension and flexion each rep
- D. Slight constant knee flexion, neutral spine, hip hinge, bar close to legs

133. A swimmer's program includes pull-ups, I/E rotation, and core anti-rotation. This addresses which needs?

- A. Only lower body power for kicking
- B. Pulling strength, rotator cuff health, and trunk stability
- C. Only flexibility for stroke mechanics
- D. Only cardiovascular endurance

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

- A. Rotational force attempting to twist the torso

- B. Sagittal extension force
- C. Sagittal flexion force
- D. Frontal plane lateral flexion

135. Before attempting the full snatch, which mobility prerequisite must be assessed?

- A. Only ankle dorsiflexion
- B. Only wrist flexion
- C. Overhead squat mobility with locked arms in a deep squat
- D. No prerequisites needed

136. Correct push-up execution includes which standards?

- A. Hips sagging with visible swayback
- B. Elbows flared to 90° from the torso
- C. Partial ROM with elbows bending 10-15°
- D. Straight line head-to-heels, chest near floor, elbows ~45°

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

- A. Continuous 3-mile runs at moderate pace
- B. 5-10 yard sprints with 25-40 second rest matching position demands
- C. 400-meter repeats with 60-second rest
- D. 60-minute cycling at 50% HRmax

138. Cable face pulls with external rotation target which muscles for which purpose?

- A. Posterior deltoids, external rotators, and mid-trapezius for shoulder health
- B. Pectoralis major for pressing strength
- C. Quadriceps for leg extension power
- D. Biceps brachii for arm size

139. A strength and conditioning specialist programs eccentric-emphasized split squats (4-second lowering) for an athlete. This eccentric emphasis targets which training adaptation?

- A. Maximum concentric power through high-velocity execution
- B. Aerobic endurance through extended set duration
- C. Eccentric strength, hypertrophy, and tendon resilience through prolonged loaded lengthening
- D. Flexibility improvement exclusively

140. A strength and conditioning specialist includes Turkish get-ups in a program. This exercise develops which primary combination of qualities?

- A. Maximum bilateral pressing strength at heavy loads
- B. Isolated biceps hypertrophy and grip endurance
- C. Maximum sprint speed and acceleration
- D. Shoulder stability, core strength, and total-body coordination

## PROGRAM DESIGN (Questions 141–184)

141. A competitive 200-meter sprinter (race lasting ~20-24 seconds at maximal effort) relies most heavily on which energy system combination?

- A. Exclusively the oxidative system
- B. Phosphagen and glycolytic systems as co-primary contributors
- C. No specific system is dominant
- D. Exclusively oxidative through fat metabolism

142. A barbell power clean is classified as a power exercise because it meets which criteria?

- A. Structural, explosive, involving multiple large muscle groups
- B. Single-joint machine isolation at slow tempo
- C. Non-structural with no spinal loading
- D. Identical to a slow curl at light resistance

143. In a session with hang snatch, back squat, incline bench, pulldown, biceps curl, and dead bug, which exercise is performed first?

- A. Biceps curl as isolation before compounds
- B. Dead bug for core pre-activation
- C. Hang snatch — explosive exercise when freshest
- D. Pulldown as pulling before pushing

144. For an advanced athlete (7+ years), which training split allows sufficient per-muscle-group volume?

- A. Total body 2×/week with 2 sets per exercise

- B. Machine-only circuit at 30% 1RM daily
- C. One session per month at maximal loads
- D. Upper/lower or push/pull/legs split

145. The repetition maximum continuum indicates 8-12 reps at 67-85% 1RM with 60-90 sec rest targets which adaptation?

- A. Maximal strength through neural adaptation
- B. Muscle hypertrophy through tension and metabolic stress
- C. Power through ballistic high-velocity movement
- D. Aerobic endurance conditioning

146. An athlete's 1RM squat is 180 kg. A strength protocol at 86% 1RM prescribes which working load?

- A. Approximately 155 kg
- B. 180 kg (full 1RM)
- C. 90 kg (50% for safety)
- D. 220 kg (1RM plus 40 kg)

147. Triphasic training employs sequential emphasis on eccentric, isometric, then concentric actions. This approach is based on which principle?

- A. All contraction types produce identical force
- B. Eccentric training has no unique benefits
- C. Each contraction type produces distinct adaptations transferring to explosive performance
- D. Concentric-only training is always superior

148. Cluster sets (5 reps as 5 singles with 15-20 sec intra-set rest) maintain bar velocity because of which mechanism?

- A. Complete glycogen resynthesis between reps
- B. Full hormonal recovery between reps
- C. Increased time under tension identical to straight sets
- D. Brief rest allowing partial PCr recovery and neural restoration

149. Contrast training pairs heavy squats at 85% 1RM with jump squats 3-4 minutes later. The rationale is which phenomenon?

- A. Pre-exhaustion reducing jump squat load requirements
- B. Post-activation potentiation priming the nervous system for enhanced power
- C. Aerobic conditioning from the rest between exercises
- D. Flexibility improvement from the heavy stretch

150. Velocity-based training terminates sets when velocity drops 20% below the fastest rep. This approach autoregulates which variable?

- A. Fatigue-induced velocity loss to maintain movement quality
- B. Heart rate response during resistance exercise
- C. Flexibility changes between sets
- D. Blood lactate concentration

151. An athlete returning from a grade II MCL sprain needs which rehabilitation component?

- A. No balance training — irrelevant to knee recovery
- B. Only bilateral exercises on stable surfaces

- C. Progressive single-leg balance on increasingly unstable surfaces
- D. Maximal load bilateral exercises only

152. In-season basketball (26 games, 14 weeks) should follow which strength programming guideline?

- A. Complete cessation of all resistance training
- B. 6 sessions/week at full preparatory volume
- C. Only stretching and bodyweight exercises
- D. 2 sessions/week with reduced volume but maintained intensity

153. The interference effect from concurrent strength and endurance training is minimized by which strategy?

- A. Performing both in the same session with no separation
- B. Separating sessions by 6-8 hours, prioritizing strength first when same-day
- C. Never training endurance under any circumstances
- D. Training only one quality and ignoring the other

154. A wrestling conditioning protocol (three 2-minute periods) should target which energy system?

- A. The glycolytic system with 2-minute high-intensity intervals
- B. Only the phosphagen system with 5-second efforts
- C. Only the oxidative system with 30-minute runs
- D. No conditioning is needed for wrestling

155. Complex training (heavy set + biomechanically similar explosive set) for volleyball: heavy squat followed by jump sets. Optimal PAP rest between heavy and explosive is approximately which duration?

- A. Zero rest — immediately after heavy set
- B. 30 seconds
- C. 3-5 minutes for neural potentiation while fatigue dissipates
- D. 20 minutes

156. An evidence-based taper before competition involves which adjustments?

- A. Increasing volume 50% and decreasing intensity
- B. Maintaining full volume and adding sessions
- C. Complete cessation for 4 weeks
- D. Reducing volume 40-60% while maintaining or slightly increasing intensity

157. An annual plan for a fall championship athlete positions general preparation at which time?

- A. The week before championship
- B. Late spring/early summer for sufficient preparation time
- C. During the competitive season itself
- D. 18 months after the championship

158. A "force-deficient" athlete (strong velocity, weak force) should emphasize which training?

- A. Heavy resistance training (85%+ 1RM) to address the force deficit
- B. Only light-load high-velocity training
- C. Only aerobic endurance training

D. Only flexibility training

159. A 4-phase reconditioning progression (ROM/activation → strength → power → sport-specific) reflects which principle?

- A. Random exercise selection with no structure
- B. Immediate return to full sport demands
- C. Systematic rebuilding from tissue healing through functional restoration
- D. Permanent restriction from activity

160. Linear periodization is characterized by which pattern?

- A. Volume and intensity both increase simultaneously
- B. Constant volume and intensity throughout
- C. Decreasing intensity with increasing volume
- D. Increasing intensity with decreasing volume across phases

161. Block periodization's typical three-block sequence is which of the following?

- A. Realization → Transmutation → Accumulation
- B. Accumulation → Transmutation → Realization
- C. Flexibility → Cardio → Endurance only
- D. Competition → Transition → General prep

162. In-season maintenance with reduced volume but maintained intensity produces which outcome?

- A. Strength and power maintenance

- B. Dramatic strength loss from volume reduction
- C. Significant additional gains
- D. Complete detraining within 48 hours

163. The transition period should last approximately how long and focus on what?

- A. 12 weeks of maximal training
- B. 6 months of complete bed rest
- C. 2-4 weeks of low-intensity active recovery and restoration
- D. Elimination entirely — train year-round at maximum

164. Jump squat peak power occurs at which loading range?

- A. 85-95% 1RM at very slow velocity
- B. 50-70% providing balanced contributions
- C. Equal power at all loads
- D. 0-30% 1RM allowing high velocity

165. Hang clean peak power occurs at approximately which loading range?

- A. 0-10% using the empty barbell
- B. 70-80% 1RM providing optimal force-velocity balance
- C. 95-100% at very slow velocity
- D. Equal at all loads

166. Plyometric frequency of 2-3 sessions/week with 48-72 hour separation is recommended because of which requirement?

- A. Musculotendinous recovery from significant eccentric loading
- B. Arbitrary with no physiological basis
- C. Cognitive processing of movement patterns
- D. Cardiovascular restoration exclusively

167. A training log: Wk1=4×8@70%, Wk3=4×6@78%, Wk5=4×5@83%, Wk7=4×3@89%. This characterizes which model?

- A. Daily undulating periodization
- B. Block periodization
- C. Linear periodization with progressive intensity and decreasing volume
- D. Random programming

168. Developing both strength and speed requires which weekly approach?

- A. Only heavy loads above 90% every session
- B. Only bodyweight exercises at max velocity
- C. Only sprint practice with no resistance training
- D. Heavy training some days, explosive exercises other days

169. A deload week (volume reduced ~40%, intensity maintained) serves which purpose?

- A. Testing 1RM under maximum fatigue
- B. Managing fatigue while maintaining stimulus for supercompensation
- C. Permanent load reduction

D. Program restart from beginning

170. A rower needs endurance, pulling strength, core stability, and lower body drive. The best combination is which of the following?

A. Rowing conditioning, rows/pull-ups, anti-movement core, front squats/RDLs

B. Only distance running and cycling

C. Only biceps curls for rowing

D. Only depth jumps for power

171. A martial artist (3-min rounds, 1-min rest) should target which energy system?

A. Only the phosphagen system

B. Only the oxidative system

C. Glycolytic primary, supplemented by phosphagen and aerobic

D. No energy system training needed

172. In-season maintenance requires preserving which variable to prevent detraining?

A. Volume at full preparatory levels

B. Frequency at 5 sessions/week

C. New exercises every session

D. Training intensity (% 1RM)

173. The annual plan organizes the year in which sequence?

A. Competition → Transition → General → Specific

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

174. A protocol of 4×12 at 70% with 60-sec rest targets which adaptation?

- A. Muscle hypertrophy through tension and metabolic stress
- B. Maximal strength with heavy neural loading
- C. Explosive ballistic power
- D. Phosphagen system development

175. A decathlete needs simultaneous sprint, endurance, jump, throw, and skill development. The best model is which of the following?

- A. Block periodization on one event for 4 weeks
- B. Only sprinting 6 months then throwing 6 months
- C. Concurrent training with undulating periodization
- D. No structured training

176. An athlete with a wrist injury preventing barbell grip should train which exercises?

- A. No training until wrist heals
- B. Only upper body machines
- C. Barbell squats with standard grip
- D. Belt squats, leg press, goblet squats with modified grip

177. A goalkeeper (explosive saves, 2-5 sec sprints, variable rest) should condition at which ratio?

- A. 1:1 oxidative
- B. 1:8 to 1:12 phosphagen with near-complete recovery
- C. 1:3 glycolytic
- D. No structured rest

178. General preparation emphasizes which qualities?

- A. Broad base of hypertrophy, strength, work capacity, and aerobic fitness
- B. Sport-specific power and speed immediately
- C. Complete rest for the entire phase
- D. Only technical skill practice

179. Specific preparation shifts emphasis to which focus?

- A. Maximum aerobic endurance only
- B. Complete rest
- C. Sport-specific power, speed, agility, and conditioning
- D. Only flexibility

180. DUP (Mon hypertrophy, Wed strength, Fri power) provides which advantage?

- A. Eliminates planning
- B. Never uses heavy loads
- C. Identical to constant programming
- D. Frequent varied stimuli preventing accommodation

181. A needs analysis for a competitive lacrosse midfielder (60-min games with repeated sprints and lower-intensity movement) should include which conditioning combination?

- A. Exclusively heavy resistance training
- B. Aerobic base, anaerobic intervals, and change-of-direction conditioning
- C. Only long-distance running at low intensity
- D. Only static stretching for 60 minutes

182. Return-to-play requires which objective criterion?

- A. Bilateral symmetry within 10%, movement competency, and medical clearance
- B. Subjective report of readiness only
- C. Walking without a limp as the sole criterion
- D. Completion of any group exercise class

183. A strength and conditioning specialist programs wave loading: 5/3/1 at 75/85/93%, then repeats at 77/87/95%. This scheme exploits which phenomenon?

- A. Progressive fatigue reducing performance
- B. Aerobic conditioning from session length
- C. PAP — heavier loads prime the nervous system for subsequent sets
- D. Flexibility from inter-set rest

184. A strength and conditioning specialist identifies an athlete's force-velocity profile as "velocity-deficient" (strong force, weak velocity). The primary programming emphasis should be which of the following?

- A. Only heavy resistance training above 90% 1RM

- B. Only aerobic endurance training
- C. Only flexibility training
- D. Light-load, high-velocity training (plyometrics, jump squats at 30-40% 1RM, sprint work)

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

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

- A. Lab isokinetic dynamometry at 25 min/athlete
- B. Vertical jump (CMJ) with Vertec — valid, reliable, practical
- C. Force plate with 3D motion capture
- D. Underwater weighing

186. A test producing consistent scores across repeated identical administrations demonstrates which property?

- A. Reliability
- B. Face validity
- C. Construct validity
- D. Criterion validity

187. During 1RM testing, an athlete lifts 155 kg successfully then fails at 160 kg. The 1RM is which value?

- A. 160 kg
- B. 157.5 kg as the average
- C. 155 kg — last successful lift with acceptable technique
- D. Test must restart

188. An athlete's CMJ = 67 cm, SJ = 54 cm. The 13 cm difference reflects which capacity?

- A. Maximum aerobic power
- B. Absolute quadriceps strength
- C. Hamstring:quad ratio
- D. Stretch-shortening cycle utilization

189. Aerobic capacity testing for 50 outdoor athletes with minimal equipment requires which test?

- A. Lab treadmill  $\text{VO}_2\text{max}$
- B. 20-meter beep test
- C. Wingate on cycle ergometer
- D. 1RM back squat

190. Skinfold assessment uses which two-step calculation?

- A. Skinfolds  $\rightarrow$  prediction equations  $\rightarrow$  body density  $\rightarrow$  body fat percentage
- B. Skinfolds directly produce body fat
- C. Skinfolds estimate bone density
- D. Skinfolds  $\times$  body weight = fat mass

191. BIA accuracy is most affected by which variable?

- A. Room temperature
- B. Shoe brand
- C. The athlete's hydration status
- D. Number of people present

192. Electronic timing eliminates which error source compared to hand timing?

- A. Wind resistance on the athlete
- B. Temperature effects on muscle speed
- C. Lane marking color affecting motivation
- D. Human timer reaction variability (0.1-0.3 sec)

193. Bilateral hop test: R=46 cm, L=36 cm (~22% asymmetry). This suggests which finding?

- A. Normal bilateral variation
- B. Clinically significant asymmetry exceeding 10-15% threshold
- C. Right leg overtrained
- D. Invalid test administration

194. Test results: squat=87th, VJ=29th, agility=55th, 1.5-mile=63rd. Highest programming priority is which quality?

- A. Explosive power — VJ disproportionately low relative to high strength
- B. Maximal strength at 87th percentile
- C. Agility at 55th percentile
- D. Aerobic endurance at 63rd percentile

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

- A. Different tests each time to prevent adaptation
- B. Athlete-selected conditions for comfort
- C. Identical conditions across sessions

D. Testing after heavy training for fatigue evaluation

196. An ACL reconstruction patient achieves 85% bilateral hop symmetry. Based on the 90% criterion, the recommendation is which of the following?

- A. Return to unrestricted competition
- B. Hop testing is irrelevant to ACL decisions
- C. Permanent restriction from sport
- D. Continue strengthening until 90% threshold is met

197. A force plate measures which variables that simpler methods cannot?

- A. Only jump height from reach difference
- B. Peak GRF, RFD, impulse, and power in addition to height
- C. Only body weight before the test
- D. Only flight time

198. The sit-and-reach test's primary limitation is which of the following?

- A. Measures only hamstring/lower back; influenced by limb proportions
- B. Requires expensive lab equipment
- C. Takes 30+ minutes per athlete
- D. Measures only shoulder flexibility

199. Goniometry provides which advantage over the sit-and-reach?

- A. Less accurate for every joint

- B. Identical information with no additional value
- C. Joint-specific ROM at any joint identifying specific restrictions
- D. Limited to hip measurement only

200. Performance testing should occur at which intervals?

- A. Daily for maximum granularity
- B. Once at career start only
- C. Randomly with no schedule
- D. Beginning and end of each major phase and pre/post-season

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

- A. 25-30 reps
- B. 10 or fewer reps
- C. 15-20 reps
- D. Exactly 1 rep

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

- A. 3-4 progressively heavier sets (~50%, 70%, 80-85% 1RM)
- B. None — attempt 1RM immediately
- C. One set of 50 light reps
- D. 10 sets of 10 at increasing loads

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

- A. Straight-line 40-yard sprint
- B. 60-second repeated vertical jumps
- C. Forward sprint, lateral shuffles, backward run in a T-shape
- D. Agility ladder with fixed footwork

204. An athlete's VJ hasn't improved after 12 weeks of plyometrics. Squat is  $1.2\times$  body weight. The modification is which of the following?

- A. Continue identical program 12 more weeks
- B. Complete cessation for 6 months
- C. Eliminate all lower body training
- D. Add heavy resistance training — squat below  $1.5\times$  limits SSC effectiveness

205. The Cooper 12-min run and 1.5-mile run share which limitation?

- A. Require expensive lab equipment
- B. Depend on self-pacing influenced by motivation and experience
- C. Test only one athlete at a time
- D. Cannot distinguish fitness levels

206. A pre-season basketball battery should assess which domains?

- A. Aerobic capacity, sprint speed, agility, power, strength, and body composition
- B. Only bench press
- C. Only body composition

D. Only flexibility

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

207. A facility for 60 athletes at NSCA upper guideline (60 sq ft/athlete) requires which floor space?

A. 600 sq ft

B. 1,200 sq ft

C. 3,600 sq ft

D. 6,000 sq ft

208. An EAP should be rehearsed at which minimum frequency?

A. Only when facility first opens

B. Only after an emergency occurs

C. Every 10 years

D. At least annually with all staff

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

A. Advanced cardiac life support at physician level

B. CPR and AED use from a recognized provider

C. EMT-paramedic certification

D. Wilderness first responder

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

- A. The care a reasonably competent professional would exercise under similar circumstances
- B. Maximum insurance coverage required by law
- C. Minimum professional salary for competence
- D. Required continuing education credits

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

- A. Inherent risks disclosed and assumed
- B. Normal training soreness
- C. Gross negligence or reckless conduct
- D. Documented risks acknowledged by participant

212. An athlete requests injury diagnosis and rehab prescription. The CSCS should do which of the following?

- A. Diagnose and prescribe independently
- B. Prescribe anti-inflammatory medication
- C. Perform surgical evaluation
- D. Refer to a qualified medical professional

213. Which activity falls within CSCS scope of practice?

- A. Diagnosing musculoskeletal injuries
- B. Designing programs, teaching technique, administering tests, managing the facility
- C. Prescribing individualized meal plans

D. Psychological counseling for depression

214. Damaged equipment should be handled by which protocol?

A. Immediately removed, tagged, documented, repaired/replaced before return

B. Continued use until complete failure

C. Hidden from athletes

D. Wait for manufacturer visit

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

A. Always comply with the coach

B. Resign without discussion

C. Decline unsafe practices and advocate for athlete safety

D. Implement but document objections privately

216. Supervision ratios should adjust based on which factors?

A. Only total athlete count

B. Only time of day

C. Only facility dimensions

D. Exercise complexity, athlete experience, and staff qualifications

217. Record keeping should include which documents?

A. Only financial records

B. Training logs, testing data, waivers, clearances, maintenance records, incident reports

- C. Only social media posts
- D. Only coach's practice plans

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

- A. Address the concern with colleague and/or supervisor
- B. Ignore the situation
- C. Encourage higher loads
- D. Post on social media

219. A facility requires closed-toe shoes; an athlete arrives in sandals. The response is which of the following?

- A. Allow training in sandals
- B. Allow barefoot training
- C. Enforce policy — proper footwear required before training
- D. Modify policy for this athlete

220. The CSCS holds which authority regarding the strength and conditioning program?

- A. No authority — coach decides everything
- B. Equipment purchasing only
- C. Off-season authority only
- D. Ultimate authority for program design, implementation, and supervision

# PRACTICE EXAM 12 — ANSWER KEY

## WITH EXPLANATIONS

---

### SECTION 1 — SCIENTIFIC FOUNDATIONS

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

1. A — The most consistently documented fiber type transition from chronic sprint and resistance training is the conversion of Type IIx fibers to the more oxidative, fatigue-resistant Type IIa phenotype within the Type II spectrum. This shift occurs because regular high-intensity contractile activity stimulates expression of Type IIa myosin heavy chain isoforms while downregulating the Type IIx isoform. The converted IIa fibers retain fast-twitch characteristics while gaining improved oxidative capacity.
2. C — The A-band represents the full length of the myosin (thick) filaments and remains constant in width during contraction because the thick filaments themselves do not shorten. Only the relative sliding position of actin over myosin changes during the contraction process. The I-band and H-zone both narrow as the thin filaments slide inward toward the M-line, but the A-band width is structurally fixed by myosin filament length.
3. B — The novice captures rapid neural adaptations (42% strength, 3% hypertrophy) because the nervous system has abundant untapped potential for improved motor unit recruitment, rate coding, and intermuscular coordination. The experienced lifter has already maximized most neural pathways and must rely on the slower process of structural hypertrophy (10%) for smaller incremental strength gains (3%). This neural-to-structural shift characterizes the progression from novice to advanced training status.
4. D — When calcium binds to troponin C, it causes a conformational change in the troponin-tropomyosin complex that shifts tropomyosin away from the myosin binding sites on the actin filament. This exposure of the binding sites allows the energized myosin heads (already cocked from prior ATP hydrolysis) to attach to actin and begin the cross-bridge cycle. Without this tropomyosin shift, the binding sites remain physically blocked and contraction cannot occur.
5. C — Average RFD = change in force ÷ change in time = 4,200 N ÷ 0.190 s = 22,105 N/s. This value represents the average rate at which force increased from baseline to peak during the 190-millisecond contraction window. RFD is a critical performance variable for explosive athletes because many sport movements require force production within time frames much shorter than the time needed to reach absolute peak isometric force.

6. A — Chronic heavy resistance training reduces the GTO's inhibitory influence on alpha motor neurons, allowing trained athletes to voluntarily produce force closer to the true structural capacity of their musculotendinous units. This neural disinhibition is a significant contributor to strength gains beyond what hypertrophy alone can provide. Untrained individuals have a larger "strength deficit" — the gap between voluntary force and structural capacity — that heavy training progressively closes.
7. D — The exponential rise from 2.0 mmol/L at 225 watts to 5.8 mmol/L at 275 watts identifies the lactate threshold — the intensity where lactate production began exceeding the body's clearance capacity. Below 225 watts, production and clearance were balanced and lactate remained relatively stable. The steep inflection point between these two workloads marks the transition to metabolically unsustainable conditions.
8. B — A 40-second all-out effort falls squarely within the glycolytic-dominant duration range (approximately 15 seconds to 2-3 minutes at near-maximal intensity). Anaerobic glycolysis rapidly breaks down muscle glycogen, producing pyruvate converted to lactate with accompanying hydrogen ion accumulation. The rising  $H^+$  concentration reduces intracellular pH, impairing cross-bridge cycling and enzymatic function — producing the high lactate and progressive power decline.
9. C — The progressive RER decrease from 0.85 to 0.76 over 4 hours reflects a gradual metabolic shift from carbohydrate toward greater fat oxidation as muscle and liver glycogen stores progressively deplete. As carbohydrate availability declines during prolonged moderate-intensity exercise, the body relies increasingly on the slower but more abundant fat oxidation pathways, producing the lower  $CO_2$ -to- $O_2$  ratio characteristic of fat metabolism.
10. A — Without oxygen to accept electrons at the end of the electron transport chain, the entire chain backs up — NADH and  $FADH_2$  cannot be reoxidized, the Krebs cycle stalls because it cannot regenerate  $NAD^+$  and FAD, and aerobic ATP production ceases entirely. This absolute oxygen requirement is why the aerobic system cannot function under anaerobic conditions, and why  $VO_{2max}$  represents the ceiling of aerobic energy production.
11. D — Despite yielding approximately 129 ATP per molecule of palmitate versus 36-38 from glucose, fat oxidation through beta-oxidation produces ATP at a rate far too slow to match the rapid energy demands of high-intensity exercise. The rate limitation — not total yield — determines which substrate dominates at any given intensity. Carbohydrate pathways produce ATP at a faster rate, making them essential when energy demand is high.
12. B — At mile 22 with blood glucose at 47 mg/dL, muscle and liver glycogen stores have become substantially depleted and the athlete is hypoglycemic. Without adequate carbohydrate substrate, the body cannot maintain the rate of ATP production required to sustain the running pace. This is the classic marathon "wall" or "bonk" that can only be prevented or delayed through strategic carbohydrate intake during the race.

13. C — The  $\text{VO}_2$  plateau at 54 mL/kg/min despite two additional workload increases, combined with an RER of 1.16, near-maximal heart rate, and blood lactate of 12 mmol/L, confirms  $\text{VO}_{2\text{max}}$ . The primary criterion (plateau in oxygen consumption despite increasing demand) is validated by multiple secondary verification criteria, confirming the athlete has reached the absolute ceiling of aerobic energy production capacity.
14. A — After stroke volume plateaus at approximately 40-60% of  $\text{VO}_{2\text{max}}$  (limited by ventricular filling time as heart rate increases), further increases in cardiac output depend entirely on continued heart rate increases driven by progressive sympathetic nervous system activation. Heart rate rises approximately linearly with exercise intensity until approaching the age-predicted maximum (approximately 220 minus age).
15. D — Net upward force =  $\text{GRF} - \text{body weight} = 2,900 - 784 = 2,116 \text{ N}$ . This net force drives upward acceleration according to Newton's Second Law ( $a = F/m = 2,116 \div 80 = 26.5 \text{ m/s}^2$ ). Only the force exceeding total system weight (body weight plus any external load) produces positive upward acceleration — the first 784 N simply supports the athlete's mass against gravity.
16. B — Torque equals force multiplied by moment arm. Near knee height with the torso inclined forward, the horizontal distance between the barbell and the L4-L5 vertebral segment reaches its maximum, creating the greatest moment arm. This position produces the highest flexion torque demand on the hip and back extensors, making it the mechanical sticking point where the lift feels heaviest despite the same barbell weight throughout.
17. C — Hydrogen ions produced by glycolytic metabolism are buffered by the bicarbonate system:  $\text{H}^+ + \text{HCO}_3^- \rightarrow \text{H}_2\text{O} + \text{CO}_2$ . The additional  $\text{CO}_2$  generated by this buffering reaction must be expelled through increased ventilation, causing the disproportionate rise in breathing rate that characterizes the ventilatory threshold. This non-linear ventilatory increase closely corresponds to the lactate threshold intensity.
18. D — Peak muscular power (the product of force  $\times$  velocity) occurs at approximately 30-60% of maximal force, where the combination of moderate force and moderate-to-high velocity produces the greatest power product. At the maximum force end (near-zero velocity), power approaches zero despite high force. At the maximum velocity end (near-zero force), power also approaches zero despite high speed.
19. A — The 22-degree difference between passive ROM ( $138^\circ$ ) and active ROM ( $116^\circ$ ) reflects the normal distinction between what external force can achieve and what voluntary muscular effort can produce. External force can move a joint beyond the limit where the individual's own muscles can actively control movement. This difference reflects the neuromuscular and motor control limits of active motion versus the structural limits of passive joint mobility.
20. B — Cardiac output = heart rate  $\times$  stroke volume =  $44 \text{ bpm} \times 118 \text{ mL} = 5,192 \text{ mL/min}$  (approximately 5.2 L/min). This resting cardiac output falls within the normal range of approximately 5 L/min, demonstrating how the trained athlete's high resting stroke volume (from

eccentric cardiac hypertrophy) compensates for the low resting heart rate (athletic bradycardia), pumping the same total volume with fewer, more powerful beats.

21. D — Blood flow redistribution during maximal exercise is accomplished through two complementary mechanisms: local metabolic vasodilation in working muscles (mediated by increased CO<sub>2</sub>, decreased O<sub>2</sub>, temperature, and metabolite accumulation) combined with sympathetic vasoconstriction in non-essential organs (digestive tract, kidneys, inactive muscles). This dual mechanism selectively directs 80-85% of cardiac output to the most metabolically active tissues.
22. C — The primary stimulus for acute growth hormone release is metabolic stress — elevated blood lactate, hydrogen ion accumulation, and reduced intracellular pH created by high-volume training with short rest periods. The 60-second rest prevents full metabolic recovery between sets, maintaining the acidic cellular environment that triggers GH secretion from the anterior pituitary. The heavy protocol with 5-minute rest minimizes metabolic stress.
23. A — Female athletes achieve significant strength gains primarily through neural adaptations — improved motor unit recruitment, enhanced rate coding, better intermuscular coordination, and reduced antagonist co-contraction. These neural mechanisms are not testosterone-dependent and account for a larger proportion of total strength gains in females because the lower testosterone environment limits the magnitude of structural hypertrophy that can occur.
24. B — A progressively declining T:C ratio over 8 weeks, combined with performance stagnation, insomnia, and elevated resting heart rate, represents the classic presentation of overtraining syndrome. The chronic imbalance between accumulated training stress and recovery capacity has produced systemic hormonal maladaptation requiring significant reduction in training volume and intensity, a structured recovery phase, and potential medical evaluation.
25. D — Wolff's Law predicts that bone remodels in response to the mechanical stresses placed upon it. Ground-based resistance exercises (squats, deadlifts, weighted lunges) combined with impact activities apply large compressive and impact forces directly to the axial and appendicular skeleton. These weight-bearing, high-force activities provide the greatest osteogenic stimulus for increasing bone mineral density.
26. C — With identical 1RM values (195 kg), the 18 cm vertical jump difference indicates superior rate of force development and power output in Athlete A. During the brief ground contact time of a vertical jump, Athlete A produces force more rapidly, generating greater impulse that translates to higher takeoff velocity and jump height. Equal maximal strength with different jump performance is the hallmark of an RFD difference.
27. A — The pronounced forward lean during sprint acceleration allows the athlete to direct ground reaction forces primarily horizontally backward against the ground. By Newton's Third Law, the ground pushes back with an equal forward-directed reaction force that overcomes the body's inertia

and generates forward momentum from a stationary start. Running upright directs forces too vertically, reducing horizontal propulsion.

28. D — Research on elite sprinters consistently demonstrates that the vertical ground reaction force applied during the brief 80-100 ms ground contact phase at maximum velocity is the primary factor distinguishing faster from slower runners. Faster sprinters produce greater vertical force relative to body weight during each ground contact, effectively "bouncing" off the ground with greater musculotendinous stiffness and force application efficiency.
29. B — The 13 cm difference between the CMJ (68 cm) and the SJ (55 cm) represents the contribution of the stretch-shortening cycle to concentric force production. The three SSC mechanisms — stored elastic energy in the musculotendinous unit, the stretch reflex from muscle spindle activation, and increased time for force development during the eccentric phase — augment the concentric takeoff beyond concentric-only capacity.
30. C — Third-class levers have the effort arm (muscle insertion near the joint) shorter than the resistance arm (external load far from the joint), creating a mechanical disadvantage for force. However, this arrangement favors speed and range of motion — a small amount of muscle shortening produces a large, fast movement at the distal end. The tradeoff is that the muscle must produce force many times greater than the external load.
31. A — Tendons and ligaments have lower metabolic activity and reduced blood supply compared to skeletal muscle tissue, resulting in slower rates of collagen synthesis, turnover, and structural remodeling. This means connective tissues require more time to adapt to increased training loads than the muscles they support. Progressive overload must be gradual enough to allow these structures to keep pace with muscular strength gains.
32. D — Slow jogging develops oxidative capacity and slow-twitch efficiency but fails to develop explosive jumping power, sprint speed, lateral agility, and anaerobic conditioning — the specific physical demands of competitive basketball. The SAID principle requires that the training stimulus specifically match the sport's demands for adaptations to transfer to competitive performance.
33. B — Eccentric force production increases with lengthening velocity up to a plateau approximately 20-60% above maximal isometric force. Athletes can safely control and lower loads exceeding their concentric 1RM, forming the basis for supramaximal eccentric training. This provides a novel overload stimulus for strength and connective tissue adaptation that concentric-only training cannot achieve.
34. C — Aerobic capacity ( $VO_{2max}$ ) declines most rapidly during detraining, with measurable reductions occurring within 1-2 weeks of inactivity and significant losses by 4-8 weeks. Maximal strength is more resistant, maintaining for 2-4 weeks or longer after cessation. This hierarchy guides rehabilitation priorities — aerobic fitness requires earlier attention while strength can be temporarily deprioritized.

35. A — The creatine kinase reaction ( $\text{PCr} + \text{ADP} \rightarrow \text{ATP} + \text{Cr}$ ) is a simple, single-step enzymatic process occurring directly in the sarcoplasm without requiring oxygen, mitochondria, or multi-step metabolic pathways. This simplicity makes it the fastest ATP-regenerating system in the body, producing ATP almost instantaneously — the rate advantage making the phosphagen system dominant during the first 6-10 seconds of maximal effort.
36. D — The "muscle memory" phenomenon is explained by retained myonuclei from prior hypertrophic training. During initial hypertrophy, satellite cells fuse with existing fibers and donate additional nuclei that persist even during detraining-induced atrophy. When training resumes, the additional nuclei accelerate the protein synthetic response, allowing faster recovery of muscle size and strength compared to individuals who never trained.
37. B — During the contract-relax PNF technique, the 6-second isometric contraction generates high tension that activates the Golgi tendon organ at the musculotendinous junction. The GTO sends inhibitory signals through an Ib inhibitory interneuron that reduce alpha motor neuron activity to the target muscle. This autogenic inhibition temporarily decreases muscle tone and resistance to stretch, allowing greater ROM immediately following the contraction.
38. A — Torque = force  $\times$  moment arm =  $(8 \text{ kg} \times 9.81 \text{ m/s}^2) \times 0.57 \text{ m} = 78.48 \text{ N} \times 0.57 \text{ m} \approx 44.7 \text{ N}\cdot\text{m}$ . Mass must first be converted to force in Newtons by multiplying by gravitational acceleration ( $9.81 \text{ m/s}^2$ ), then multiplied by the perpendicular distance from the joint axis to the gravitational force line. This demonstrates why even moderate dumbbell weights create substantial shoulder torque demands.
39. C — Vasodilation in working muscles during moderate aerobic exercise reduces total peripheral resistance — the resistance to blood flow through the systemic circulation. Because diastolic blood pressure reflects peripheral resistance during the cardiac relaxation phase, the reduced resistance from muscle vasodilation counterbalances the increased cardiac output, preventing diastolic pressure from rising during steady-state exercise.
40. D — Cortisol's acute catabolic actions include stimulating protein degradation (breaking down amino acids from muscle protein) and gluconeogenesis (converting those amino acids into glucose in the liver). These processes mobilize amino acid substrates to produce glucose for the brain — which is obligatorily glucose-dependent — and other glucose-requiring tissues during periods of metabolic stress when glycogen stores are depleting.
41. B — Stable resting testosterone with decreased cortisol produces a favorable improvement in the testosterone-to-cortisol ratio, indicating a positive anabolic-catabolic balance. Combined with continued performance gains, adequate sleep, and subjective recovery between sessions, this hormonal profile confirms successful adaptation to the training program without signs of overreaching or overtraining.
42. A — Enhanced androgen receptor density from chronic resistance training increases the muscle's sensitivity and responsiveness to circulating testosterone at the tissue level. Each testosterone

molecule produces a stronger anabolic signal, potentially amplifying the hypertrophic and strength response to training even without changes in basal circulating hormone concentrations. This is a significant tissue-level adaptation that improves the training response.

43. C — The crossover concept describes the intensity-dependent progressive shift from predominantly fat oxidation at low exercise intensities to predominantly carbohydrate oxidation at higher intensities. As the body requires faster rates of ATP production at increasing workloads, it progressively relies more on the carbohydrate pathways that can produce ATP at a faster rate than the slower fat oxidation pathways.
44. D — The Cori cycle recycles lactate through the liver, where hepatocytes convert it back to glucose via gluconeogenesis. This recycled glucose is released into the blood for use by working muscles and the brain. The pathway is particularly critical during sustained exercise because it helps maintain blood glucose levels as glycogen depletes, providing continued substrate for the obligatorily glucose-dependent brain.
45. B — The combination of 9-month amenorrhea, grossly inadequate caloric intake (1,100 kcal with 2.5 hours daily training), DEXA-confirmed decreased lumbar BMD, and recent stress fractures represents Relative Energy Deficiency in Sport (RED-S). Low energy availability is the driving factor — insufficient calories relative to exercise expenditure disrupts the hypothalamic-pituitary-ovarian axis, causing menstrual dysfunction and compromised bone health.
46. A — RED-S in male athletes produces suppressed testosterone (from disrupted HPG axis), decreased bone mineral density (from impaired hormonal signaling), impaired immune function (from insufficient energy for immune processes), and declining performance (from cumulative energy deficit). Chronic low energy availability drives these consequences regardless of sex, expanding beyond the original female athlete triad concept.
47. C — The stretch reflex (myotatic reflex) is a monosynaptic reflex — involving only a single synapse between the afferent sensory neuron from the muscle spindle and the efferent alpha motor neuron. This single-synapse arrangement makes it the fastest possible reflexive contraction in the human body, occurring in milliseconds. During plyometric landing, the rapid eccentric stretch activates spindles that produce this reflex.
48. D — Contact times increasing from 165 to 350 ms with declining rebound height confirms fatigue and loss of SSC effectiveness. When amortization exceeds approximately 250 ms, elastic energy dissipates as heat and the stretch reflex contribution diminishes. Plyometric training is quality-based — every repetition should demonstrate maximal effort with minimal contact time. Continuing trains degraded movement patterns with no power benefit.
49. B — Both athletes produce identical peak force (3,000 N), but Athlete A reaches peak in 130 ms versus 280 ms for Athlete B — demonstrating superior rate of force development. During the limited ground contact time of a vertical jump, faster RFD produces greater impulse (area under

the force-time curve), resulting in higher takeoff velocity and therefore greater jump height despite equal peak force.

50. A — When the amortization phase exceeds approximately 250 ms, the elastic energy stored in the musculotendinous unit during the eccentric landing dissipates as heat rather than being returned as mechanical work during the concentric takeoff. Additionally, the stretch reflex contribution from muscle spindle activation diminishes because the rapid eccentric-to-concentric transition has been disrupted by the prolonged delay.
51. C — In the second-class lever of the standing calf raise, the effort arm (distance from the calcaneus to the ball of the foot) is longer than the resistance arm (distance from the ankle joint to the ball of the foot). This creates a mechanical advantage greater than one, meaning the gastrocnemius and soleus can produce movement against resistance greater than in a third-class arrangement.
52. D — The principle of accommodation predicts that the response to a constant, unchanging stimulus diminishes over time as the body fully adapts. After 22 weeks of identical programming, introducing variation in exercises, loads, volumes, or periodization model provides novel stimuli the body has not yet adapted to, overcoming the plateau and restarting the progressive adaptation process.

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

53. B — Racing thoughts, worry about failure, and negative self-talk are cognitive anxiety symptoms — the mental component of competitive anxiety characterized by negative thought patterns and fear-based cognition. Cognitive anxiety requires cognitive interventions such as thought stopping, positive self-talk replacement, and cognitive restructuring, rather than physical relaxation techniques which target somatic symptoms.
54. D — A maximal deadlift is a gross motor, high-force task that benefits from relatively high arousal levels. According to the inverted-U hypothesis, elevated physiological activation supports maximal muscle recruitment, aggressive force production, and the intense focused effort required for near-maximal lifting. Fine motor precision tasks require lower optimal arousal because excessive activation causes tremor and attentional narrowing.
55. C — The most effective goal-setting approach combines outcome goals (long-term competitive targets providing direction), performance goals (specific measurable benchmarks for tracking progress), and process goals (daily controllable training behaviors directing immediate effort). This hierarchical structure connects daily actions to long-term aspirations, providing both sustained motivation and daily accountability.
56. D — Self-efficacy, as defined by Bandura, is task-specific and situation-specific — an athlete can have high self-efficacy for squatting but low self-efficacy for Olympic lifting. This distinguishes it from general self-confidence, which is a broad personality disposition applying across many

situations. Self-efficacy changes based on direct experience, observation, encouragement, and physiological state interpretation within specific contexts.

57. B — Observing a teammate of similar ability and experience succeed provides vicarious experience — one of Bandura's four sources of self-efficacy. Seeing someone of comparable capability complete a challenging task provides evidence that success is achievable, strengthening the observer's belief in their own capacity. Vicarious experience is most powerful when the model closely matches the observer in relevant characteristics.
58. A — "Your hips rose too fast during the pull" describes the quality of the movement pattern — how the technique was executed rather than the outcome. This is knowledge of performance (KP), which provides actionable information the athlete can use to correct technique on subsequent repetitions. Knowledge of results (KR) would describe the outcome, such as "That was a failed lift."
59. C — The contextual interference effect demonstrates that random practice produces slower initial performance but significantly better long-term retention and transfer to novel contexts. The constant task-switching forces deeper cognitive processing during each trial, building more robust motor program representations that persist over time and transfer more effectively to new situations.
60. D — The guidance hypothesis states that providing extrinsic feedback after every repetition creates dependency on external correction. The athlete learns to wait for the coach's input rather than developing their own internal error-detection capabilities through proprioceptive attention. Reducing feedback frequency forces the athlete to develop self-monitoring skills that produce more durable, self-sustaining motor learning.
61. B — Memory consolidation during rest intervals is the neurological process of stabilizing and transferring motor memories from short-term to long-term storage. Distributed practice allows this consolidation process to occur between practice bouts, producing more durable motor program representations that resist forgetting. Massed practice does not provide sufficient inter-trial time for effective neural consolidation.
62. A — The autonomous stage is characterized by automatic, consistent skill execution with minimal conscious attention needed for technique. Cognitive resources are freed for higher-order strategic processing — monitoring the environment, making tactical decisions, and adjusting performance in real time. This is the stage where an experienced lifter can focus on bar speed and session strategy rather than body positions.
63. C — Athletic burnout is characterized by three interrelated dimensions: emotional exhaustion (feeling physically and psychologically drained), depersonalization (cynicism and emotional detachment from the sport), and reduced sense of personal accomplishment (feeling that effort produces no meaningful results). Burnout develops over weeks to months and is distinct from acute anxiety or normal mood fluctuation.

64. D — Increasing isolation, persistent feelings of worthlessness, lost interest in previously enjoyed activities, and expressed hopelessness are potential warning signs of clinical depression in an adolescent. The strength and conditioning specialist must recognize these signs as beyond normal mood fluctuation and recommend that parents seek evaluation from a qualified mental health professional.
65. B — Self-determination theory identifies autonomy (sense of choice and control), competence (feelings of mastery and effectiveness), and relatedness (meaningful connection to others and belonging) as the three basic psychological needs supporting intrinsic motivation. When all three needs are satisfied through the training environment, athletes develop the most sustainable and resilient form of internal drive.
66. A — Extreme weight manipulation, meal avoidance, excessive exercise, and weight preoccupation are recognized warning signs of disordered eating requiring professional evaluation. Diagnosing and treating eating disorders is entirely outside the CSCS scope of practice. The specialist must refer the athlete to a qualified healthcare professional for appropriate assessment and intervention.
67. C — When a pitcher throws a fastball and then a changeup, the overall speed and absolute force of execution change (variable parameters), while the invariant features — relative timing of muscle activations, relative force proportions, and fundamental spatial pattern — remain constant. This variable parameter adjustment is the functional advantage of generalized motor programs.
68. D — Scanning the entire court to identify open teammates requires broad-external attentional focus — perceiving multiple external stimuli across a wide visual field simultaneously for tactical decision-making. This allows the point guard to process multiple defenders, teammates, and spatial relationships before narrowing focus to execute a specific pass as the play develops.
69. B — Consistent practice excellence with systematic competitive underperformance, combined with intense worry and disruptive negative self-talk, indicates choking under pressure. Excessive cognitive anxiety in high-stakes situations disrupts the automatic motor execution that the athlete reliably demonstrates in the low-pressure practice environment.
70. A — Fear of re-injury after ACL reconstruction is a recognized psychological barrier to successful return to sport. Gradually reintroducing sport-specific movements at progressive intensities builds physical confidence through mastery experiences, while referral to a sport psychologist addresses cognitive and emotional components through evidence-based interventions such as graded exposure and cognitive restructuring.
71. C — Research consistently demonstrates that athletes experiencing significant psychological distress during rehabilitation — including fear, frustration, depression, and social isolation — have longer recovery times and higher re-injury rates. Psychological factors significantly influence rehabilitation outcomes and return-to-play success, underscoring the importance of addressing psychological well-being alongside physical recovery.

72. D — Research demonstrates that reducing feedback frequency from 100% to approximately 50% of trials produces better long-term retention despite potentially slower initial acquisition. The reduced frequency forces athletes to attend to proprioceptive and kinesthetic information, developing internal error-detection capabilities. This self-monitoring skill produces more durable, self-sustaining motor learning.
73. B — Past performance accomplishment is the most powerful of Bandura's four self-efficacy sources. Successfully completing 200 kg provides direct, personal evidence of capability at this load level, creating the strongest possible confidence that 205 kg is achievable. Mastery experiences generate stronger and more resilient efficacy beliefs than vicarious observation, verbal encouragement, or physiological state interpretation.
74. A — Muscle tension, elevated heart rate, and rapid breathing are somatic anxiety symptoms — the physiological activation component of competitive anxiety. Physical relaxation techniques such as progressive muscle relaxation and diaphragmatic breathing directly target these symptoms by teaching systematic tension release and engaging the parasympathetic nervous system to reduce cardiovascular and respiratory activation.
75. C — Effective mental imagery engages visual (seeing the performance), kinesthetic (feeling the muscular sensations), auditory (hearing environmental sounds), and emotional (experiencing confidence and composure) components simultaneously. Multi-sensory engagement creates the richest, most vivid mental rehearsal that transfers most effectively to actual competitive performance.

### **NUTRITION (Questions 76–95)**

76. D — A 110 kg athlete at 2.2 g/kg/day requires 242 grams of protein daily ( $110 \times 2.2 = 242$ ). This upper-end recommendation supports the elevated rates of muscle protein synthesis, tissue repair from training-induced micro-damage, and anti-catabolic demands of heavy resistance training. The general population RDA of 0.8 g/kg (88 grams) is insufficient for this athletic population.
77. B — Leucine is the branched-chain amino acid identified as the primary trigger for activating the mTOR signaling pathway that initiates muscle protein synthesis. A threshold of approximately 2-3 grams of leucine per protein-containing meal ensures optimal stimulation of the protein synthetic machinery. This leucine threshold is a key consideration when evaluating protein source quality for athletic recovery.
78. A — Chronically inadequate dietary fat intake (below 15-20% of total calories) impairs steroid hormone production because cholesterol — a lipid molecule — is the essential precursor for testosterone synthesis. Additionally, fat-soluble vitamins (A, D, E, K) require dietary fat for intestinal absorption. Both consequences — hormonal disruption and vitamin malabsorption — compromise health, recovery, and training adaptation.

79. C — Exercise-associated hyponatremia occurs when excessive plain water intake during prolonged exercise dilutes blood sodium concentration below safe levels. Consuming 3 liters per hour for 4 hours without sodium replacement dramatically reduces serum sodium relative to the sodium lost through sweat. Symptoms range from confusion and nausea to seizures, coma, and potentially death in severe cases.
80. D — The maintenance-only approach (3-5 grams per day without loading) achieves full intramuscular creatine saturation in approximately 28 days of consistent daily supplementation. This is equally effective as the loading protocol (20 g/day for 5-7 days) for reaching the same saturated endpoint — the only difference is that gradual accumulation takes 4 weeks instead of 1 week.
81. B — Caffeine's primary ergogenic mechanism is blocking adenosine receptors in the central nervous system. Adenosine is a neuromodulator that promotes drowsiness and reduces neural activity; blocking these receptors reduces fatigue perception, increases alertness and cognitive focus, and enhances pain tolerance during high-intensity effort. These central effects improve both endurance and high-intensity exercise performance.
82. A — Beta-alanine increases intramuscular carnosine, which functions as an intracellular hydrogen ion buffer during high-intensity exercise. This buffering capacity is most beneficial for activities lasting 1-4 minutes where glycolytic H<sup>+</sup> accumulation is the primary performance limiter. Shorter activities are phosphagen-dependent and longer activities are primarily aerobic — neither benefits substantially from enhanced intracellular buffering.
83. C — NSF Certified for Sport and Informed Sport are third-party certification programs that independently test for banned substances, verify label accuracy, and screen for undeclared contaminants. Athletes subject to WADA anti-doping regulations should use only products carrying these certifications to minimize the risk of inadvertent positive drug tests from contaminated supplements.
84. D — During caloric deficit, protein needs increase to 2.0-2.4 g/kg/day to maximize preservation of lean muscle mass. The elevated intake provides additional amino acid substrate to counteract the accelerated protein degradation that occurs during energy restriction. Combined with maintained resistance training, this represents the strongest evidence-based defense against lean mass loss during intentional weight reduction.
85. B — Gastrointestinal distress — including nausea, bloating, abdominal cramping, and diarrhea — is the most common side effect limiting the practical use of sodium bicarbonate. The alkaline nature of the compound and the large dose required (0.2-0.3 g/kg) can significantly irritate the gastrointestinal tract. Some athletes use enteric-coated capsules or serial loading protocols to improve tolerability.
86. A — A 72 kg athlete at 10 g/kg/day requires 720 grams of carbohydrate daily ( $72 \times 10 = 720$ ). This upper-end recommendation supports the extreme glycogen demands of high-volume endurance

training, where daily glycogen depletion and replenishment cycles are substantial. Meeting this target requires strategic planning of carbohydrate-dense meals distributed throughout the day.

87. C — Documented consequences of vitamin D deficiency in athletes include impaired muscle function (reduced strength and power output), compromised immune competence (increased illness susceptibility), and elevated risk of stress fractures with decreased bone mineral density. Athletes training indoors or living at northern latitudes with limited UV exposure are at greatest risk for insufficiency.
88. D — Vitamin C enhances non-heme iron absorption by converting ferric iron ( $\text{Fe}^{3+}$ ) to the more bioavailable ferrous form ( $\text{Fe}^{2+}$ ) in the intestinal lumen. This conversion is particularly important for athletes depending on plant-based iron sources, which contain only non-heme iron with inherently lower bioavailability than the heme iron found in animal products.
89. B — When rapid glycogen recovery is essential (two sessions within 8 hours), consuming 1.0-1.5 g/kg of carbohydrate within 30 minutes of the first session capitalizes on the period of maximal glycogen synthase activity. This enzyme is most active immediately post-exercise and decreases progressively over the following hours, making early intake critical for maximizing resynthesis rate.
90. A — Plant-based athletes achieve adequate essential amino acid intake by consuming a variety of complementary protein sources throughout the day. Different plant proteins have different amino acid limitations — grains are low in lysine but adequate in methionine, while legumes have the opposite profile. Combining multiple sources across meals provides all essential amino acids in adequate quantities.
91. C — Casein protein forms a gel-like structure in the acidic stomach environment that dramatically slows gastric emptying and digestion. This slow, sustained release provides a continuous supply of amino acids into the bloodstream throughout the 7-9 hour overnight fasting period when no other protein is consumed. Research demonstrates that 30-40 grams of casein before sleep supports overnight muscle protein synthesis.
92. D — High-glycemic index foods produce rapid blood glucose and insulin responses, making them most appropriate during and immediately after exercise. During exercise, rapid glucose delivery supports ongoing energy needs; after exercise, the fast absorption rate and insulin response maximize glycogen synthase activity and amino acid uptake during the critical recovery window.
93. B — Glutamine has limited evidence for promoting muscle growth in healthy, well-nourished athletes who already consume adequate protein. While glutamine plays important roles in immune function and gut health, it is not classified among supplements with strong ergogenic evidence for hypertrophy or performance. Supplements with robust evidence include creatine, caffeine, beta-alanine, and sodium bicarbonate.

94. A — Dietary fat serves essential physiological functions: steroid hormone production (cholesterol is the testosterone precursor), absorption of fat-soluble vitamins (A, D, E, K), cell membrane integrity (phospholipid bilayers), and provision of essential fatty acids (linoleic and alpha-linolenic acid) the body cannot synthesize. Adequate intake of 20-35% of total calories ensures these functions are maintained.
95. C — The general fluid intake guideline of 200-300 mL every 15-20 minutes during competition helps prevent body weight loss exceeding 2%, the threshold where measurable performance impairments begin. Individual sweat rates vary significantly based on body size, exercise intensity, and environmental conditions, so the guideline should be personalized using pre- and post-exercise body weight measurements.

## **SECTION 2 — PRACTICAL/APPLIED**

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

96. D — A lateral weight shift during the squat descent, with one hip dropping lower than the other, typically indicates either a unilateral hip mobility restriction (one hip lacks adequate flexion, internal rotation, or adduction ROM) or a strength asymmetry between the two legs. The athlete compensates by shifting weight toward the more mobile or stronger side. Targeted mobility work and unilateral strengthening address the underlying asymmetry.
97. B — Excessive rib flare during the overhead press indicates the anterior core musculature (rectus abdominis, internal obliques, transverse abdominis) is failing to maintain proper rib-pelvis alignment under load. When the core cannot stabilize the ribcage, the athlete compensates by extending through the thoracolumbar junction instead of pressing through a neutral spine. Cueing "ribs down" corrects this pattern.
98. A — Stopping 20° short of full elbow extension eliminates the initial pulling phase from a fully lengthened position, reducing the training stimulus to the lats at their longest muscle length. This initial range is where the stretch-shortening cycle contribution is greatest and where the lats have the most mechanical demand. Full ROM pull-ups produce greater lat activation and development than partial-range repetitions.
99. C — A negative shin angle (shin tilting backward rather than forward) during split squats reduces the knee flexion moment and shifts the loading emphasis from the quadriceps to the hip extensors (gluteus maximus and hamstrings). While this may be intentional for posterior chain emphasis, it should be recognized as a technique variation rather than assumed as the default split squat position.
100. D — Positioning the bar too high on the lower abdomen rather than directly over the hip crease creates uncomfortable pressure on the abdominal organs and reduces the mechanical advantage for hip extension. The bar should sit in the hip crease where the bony pelvis provides a stable, comfortable shelf and the moment arm for glute activation is optimized.

101. B — The NSCA's top-down teaching progression for the power clean begins with the front squat to establish the receiving position — developing comfort with the bar on the anterior deltoids, the high-elbow rack posture, and the upright torso position. This ensures the athlete can safely and confidently catch the bar before any explosive pulling mechanics are introduced.
102. A — When spotting dumbbell pressing exercises, the spotter applies assistance at the wrists near the athlete's hands. Spotting at the elbows creates a dangerous fulcrum effect, and the dumbbells themselves may move independently if gripped directly. Wrist contact allows the spotter to effectively guide the load in the intended direction while the athlete maintains control of each dumbbell.
103. C — Novice athletes entering plyometric training should begin with low-to-moderate intensity exercises (squat jumps, countermovement jumps, box jumps stepping down) at 80-100 foot contacts per session. High-intensity exercises such as depth jumps and excessive volumes require the connective tissue conditioning and movement competency developed through progressive plyometric experience over multiple training cycles.
104. D — During maximal or near-maximal compound lifts, the Valsalva maneuver (forceful exhalation against a closed glottis) creates extreme intra-abdominal pressure that provides essential spinal stabilization for trained athletes. This technique is appropriate only for healthy individuals performing heavy loads where the spinal stabilization benefit outweighs the acute blood pressure response. It is contraindicated for individuals with cardiovascular risk factors.
105. B — Significant spinal rounding with body momentum during bent-over rows indicates the load exceeds what the athlete can control with proper technique. The set should be terminated immediately, the load reduced, and the athlete cued to maintain rigid spinal neutrality with the pulling motion initiated by deliberate scapular retraction before the elbows bend. This sequence protects the spine and ensures proper muscle engagement.
106. A — Single-arm dumbbell rows develop unilateral pulling strength matching the one-arm demands of throwing, while the offset loading creates an anti-rotation challenge for the core musculature. This combination of unilateral pulling and anti-rotation stability directly addresses the sport-specific demands of baseball, where throwing, fielding, and batting all involve asymmetric force production with rotational core demands.
107. C — A loud, flat-footed landing with minimal knee flexion indicates the athlete is not absorbing impact forces through progressive joint flexion. This stiff landing transmits excessive forces directly through the ankle, knee, and hip joints, increasing the risk of acute joint injury and chronic overuse damage. Proper landing requires soft contact with progressive hip and knee flexion and neutral spinal alignment.
108. D — The Nordic hamstring curl provides high-intensity eccentric loading to the hamstrings at long muscle lengths, specifically targeting the conditions under which hamstring strains most commonly occur — during the late swing phase of sprinting when the hamstrings are lengthening

rapidly while contracting eccentrically to decelerate knee extension. Research demonstrates significant hamstring injury risk reduction from Nordic curl programs.

109. B — Receiving the power snatch with bent elbows creates an unstable overhead position because the arms cannot provide rigid skeletal support for the barbell. The bent-arm position allows the bar to drift forward or backward unpredictably, creating risk of losing the bar and potential shoulder, wrist, or spinal injury. Locked-out arms directly over the base of support are essential for safe overhead receiving.
110. A — Rotation should occur primarily through the thoracic spine and hips, which are anatomically designed for rotational movement. The lumbar spine has limited rotational ROM (approximately 5° per segment), and forcing rotation through this region under load creates excessive stress on the intervertebral discs and facet joints. Cueing hip and thoracic rotation while stabilizing the lumbar spine corrects this pattern.
111. C — Tempo prescriptions (3-second eccentric, 2-second pause) increase the total time under tension per set, which is a primary stimulus for muscle hypertrophy. The pause at the bottom eliminates the stretch-shortening cycle, developing positional strength and awareness at the most challenging range of motion. For novice athletes, tempo work also reinforces proper body positions and movement control throughout the squat.
112. D — "Push your hips straight back" redirects the movement from a knee-dominant squat pattern to the hip-dominant hinge pattern that defines the RDL. The cue encourages posterior hip displacement while maintaining minimal forward knee travel, preserving the slight constant knee flexion that characterizes correct RDL technique. This reestablishes the hip hinge as the primary movement with the hamstrings and glutes as prime movers.
113. B — Farmer's walks develop grip endurance (sustained heavy holding throughout the carry distance), core stability (resisting trunk flexion, lateral deviation, and rotation under load), and postural strength (maintaining upright spinal alignment while walking with heavy loads). These qualities transfer directly to sport performance and represent a functional core training approach superior to isolated trunk exercises.
114. A — Forward head posture and rounded shoulders at end range indicate insufficient activation of the scapular retractors (middle trapezius and rhomboids) and cervical extensors that should maintain proper head-neck-shoulder alignment during pulling movements. Cueing "chest up, chin tucked, squeeze your shoulder blades together" promotes proper scapular retraction and cervical alignment through the full ROM.
115. C — The landmine press provides an angled pressing path (approximately 45-75° depending on body position) that trains the pressing pattern without requiring the full overhead range of motion. For athletes with limited overhead mobility due to shoulder, thoracic, or other restrictions, this modification allows continued pressing training while mobility is improved through targeted corrective work.

116. D — The kettlebell swing is a hip hinge movement where all force production originates from the hip extensors — primarily the gluteus maximus and hamstrings — through explosive hip extension. The arms serve only to connect the body to the kettlebell; they do not actively lift the weight. The swing should be powered by a forceful hip snap, not shoulder flexion or lumbar hyperextension.
117. B — Excessive forward lean during dips shifts the mechanical emphasis from the triceps (which work hardest in an upright torso position) toward the pectoralis major (which becomes the primary mover as the torso inclines forward). While this may be intentional for chest emphasis, athletes targeting triceps development should maintain a more upright position throughout the movement.
118. A — Band-resisted sprints apply horizontal resistance that specifically overloads the horizontal force production component of the acceleration phase. The athlete must generate greater horizontal ground reaction force to overcome the band resistance, developing the specific force application pattern needed for rapid forward acceleration from a standing or three-point start.
119. C — Proper box jump landing requires soft contact with hip and knee flexion to absorb impact forces, a neutral spine to protect the lumbar structures, and knees tracking over the toes to protect the knee joint. This athletic landing position distributes impact forces across multiple joints rather than concentrating them at a single point. Stiff-legged or heel-first landings dramatically increase injury risk.
120. D — Sled pushes develop horizontal force production and acceleration mechanics that directly replicate the blocking demands of offensive linemen. The low body position, forward lean, and horizontal driving action against resistance mirror the force application pattern of pass and run blocking, making sled pushes one of the most sport-relevant conditioning tools for this position.
121. B — Medial knee collapse (valgus) during the squat ascent indicates weakness in the hip abductors and external rotators, primarily the gluteus medius. When these muscles cannot control femoral adduction and internal rotation under load, the knee collapses inward. Cueing "drive your knees out over your toes" provides immediate correction while targeted strengthening addresses the root cause.
122. A — The reverse lunge reduces anterior knee stress because stepping backward eliminates the eccentric deceleration demand that occurs when the front foot strikes the ground during a forward lunge. In the reverse lunge, the front leg remains relatively stationary with a more vertical shin, reducing the anterior-directed shear forces transmitted through the patellofemoral joint and quadriceps tendon.
123. C — The hex bar positions the load at the athlete's sides rather than in front, centering resistance closer to the body's center of mass. This shorter horizontal distance between the load and the lumbar spine reduces the moment arm and therefore the flexion torque on the lumbar spine. The result is decreased spinal loading compared to the conventional barbell deadlift.

124. D — Resistance bands provide minimum resistance at the bottom (where the band is least stretched) and maximum at the top (where the band is fully stretched). This accommodating profile challenges the athlete most in the mechanically strongest lockout position where free weights alone become relatively easy, training the athlete to produce force aggressively through the complete range of motion.
125. B — For a medicine ball rotational throw to qualify as plyometric, it must be performed with maximal speed and minimal transition time between the eccentric catch and concentric throw. This rapid stretch-shortening cycle execution stores and returns elastic energy and activates the stretch reflex — the mechanisms that define plyometric exercise. Paused, slow, or heavy throws eliminate these mechanisms.
126. A — Olympic lifting platforms must be separated from general traffic areas with adequate clearance on all sides for dropped barbells and failed lift attempts. Athletes and staff should never walk behind or beside someone performing Olympic lifts because dropped bars can bounce unpredictably. Safety clearance is the primary positioning consideration for platform placement.
127. C — Groups of 3 per squat rack create an efficient rotation: one athlete squats, one spots, and one rests between sets. This structure maximizes training density by keeping all 30 athletes productively engaged, ensures every working athlete has a dedicated spotter for safety, and maintains appropriate supervision ratios throughout the session.
128. D — Barbell collars prevent weight plates from sliding off the ends of the barbell during exercise. Without collars, plates can shift due to uneven pressing, asymmetric loading during racking, or balance loss, causing sudden weight redistribution that may result in loss of control and injury. Collars are a non-negotiable safety requirement for all loaded barbell exercises.
129. B — Power snatches are the explosive exercise requiring the highest neuromuscular coordination, rate of force development, and technical precision. These qualities degrade rapidly with fatigue, so power exercises must be performed first when the athlete is freshest. The remaining exercises follow in descending order of technical demand: core multi-joint → assistance → core stability.
130. A — A single bench press spotter uses an alternated grip (one hand pronated, one supinated) close to the center of the bar for maximum security and symmetric upward force application. The alternated grip prevents the bar from rolling in either direction, and central positioning allows smooth bilateral assistance without interfering with the athlete's pressing mechanics.
131. C — An athlete who demonstrates explosive performance on the field but struggles with heavy barbell exercises has a maximal strength deficit — their power expression outpaces their force production capacity. Heavy resistance training at 85%+ 1RM develops the larger force foundation upon which explosive movements draw, allowing even greater power output when combined with existing explosiveness.

132. D — Correct Romanian deadlift technique includes slight constant knee flexion maintained throughout, a flat neutral spine, a hip hinge pattern (not a squat), and the barbell tracking close to the legs during both descent and ascent. The RDL targets hamstrings and glutes through controlled eccentric hip flexion with the primary movement occurring at the hip joint.
133. B — Pull-ups develop upper body pulling strength essential for generating propulsive force during the swim stroke. Internal/external rotation exercises protect the rotator cuff from repetitive overuse injury common in swimmers. Core anti-rotation work develops trunk stability needed for efficient force transfer between upper and lower body during swimming.
134. A — The Pallof press trains the core musculature to resist rotational force — an external cable or band load attempts to twist the torso while the athlete actively maintains neutral trunk alignment. This anti-rotation function develops spinal stability critical for protecting the lumbar spine during athletic movements involving rotational forces.
135. C — The snatch requires receiving the barbell overhead with fully locked arms while in a deep squat with an upright torso. Overhead squat mobility assessment verifies that the athlete can maintain a stable, locked-arm overhead position while squatting to full depth. Without this prerequisite mobility, attempting the snatch creates significant injury risk to the shoulders, wrists, and spine.
136. D — Correct push-up execution maintains a straight line from head to heels with core braced throughout, chest touches or nearly touches the floor for full ROM, and elbows track at approximately 45 degrees from the torso. This elbow position maximizes pressing muscle stimulus while protecting the shoulder from impingement that occurs at extreme 90-degree flare angles.
137. B — Sprint intervals of 5-10 yards with 25-40 seconds rest precisely replicate the offensive lineman's competitive demands — short maximal-effort plays followed by brief huddle recovery. This protocol targets the phosphagen system at the sport-specific work-to-rest ratio, ensuring conditioning adaptations transfer directly to the repeated short-burst pattern of game play.
138. A — Face pulls with external rotation target the posterior deltoids, infraspinatus, teres minor, and middle trapezius — muscles critical for shoulder health, postural balance, and injury prevention in athletes performing heavy pressing movements. Strengthening these posterior structures balances the anterior-dominant pressing work and protects the shoulder from impingement.
139. C — Eccentric-emphasized split squats with a prolonged lowering phase (4 seconds) develop eccentric strength (force production during muscle lengthening), stimulate hypertrophy through extended time under tension, and build tendon resilience through progressive eccentric loading. These adaptations are particularly valuable for injury prevention in athletes performing high-velocity deceleration movements.
140. D — The Turkish get-up requires the athlete to transition from lying to standing while maintaining a weight locked out overhead through multiple movement planes. This exercise develops shoulder

stability under load, core strength in multiple directions, and total-body coordination and proprioception — making it uniquely valuable for functional stability that transfers to diverse athletic demands.

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

141. B — The 200-meter sprint (approximately 20-24 seconds at maximal intensity) relies on both the phosphagen system (dominant for the first 6-10 seconds including the starting drive and early acceleration) and the glycolytic system (increasingly dominant from approximately 10 seconds onward as PCr depletes). Both systems are co-primary contributors, with the aerobic system providing a minor supplementary role.
142. A — The power clean meets all criteria for power exercise classification: it is structural (directly loading the axial skeleton), performed explosively (requiring maximal-velocity triple extension), and involves multiple large muscle groups (quadriceps, glutes, hamstrings, back extensors, deltoids, trapezius) in a coordinated explosive movement pattern.
143. C — The hang snatch is the explosive exercise requiring the highest neuromuscular coordination, rate of force development, and technical precision. These qualities degrade rapidly with fatigue, so the hang snatch must be performed first when the athlete is freshest. Subsequent exercises follow the standard hierarchy: core multi-joint → assistance → core stability.
144. D — Advanced athletes with 7+ years of training require greater volume per muscle group to stimulate continued adaptation. An upper/lower or push/pull/legs split allows greater exercise volume per session while providing 48-72+ hours of recovery between sessions targeting the same muscle groups. This organization supports the higher per-muscle-group volume that advanced athletes need.
145. B — The 8-12 repetition range at 67-85% 1RM with 60-90 second rest targets muscle hypertrophy through the combined stimuli of mechanical tension and metabolic stress. The moderate-to-heavy loading provides sufficient mechanical tension, while the higher repetitions and short rest accumulate lactate and hydrogen ions, creating the metabolic conditions that drive the protein synthesis signaling cascade.
146. A —  $86\% \text{ of } 180 \text{ kg} = 154.8 \text{ kg}$ , rounded to approximately 155 kg per working set. Five sets of 3 at this load with 3-5 minutes rest represents a heavy strength protocol targeting near-maximal motor unit recruitment and neural adaptation within the established parameters for maximal strength development.
147. C — Triphasic training recognizes that eccentric, isometric, and concentric muscle actions each produce distinct neural and structural adaptations. Eccentric training develops force absorption and lengthening strength, isometric training develops force at specific joint angles and RFD, and concentric training develops force production and speed. Sequential emphasis optimizes the transfer to explosive athletic performance.

148. D — The brief 15-20 second intra-set rest in cluster sets allows partial phosphocreatine recovery and neural restoration between individual repetitions. This prevents the progressive velocity decline that occurs in traditional straight sets as fatigue accumulates. By maintaining bar velocity and movement quality, cluster sets provide a superior stimulus for power and rate of force development.
149. B — Post-activation potentiation describes the enhancement of explosive performance following a heavy conditioning stimulus. The heavy squat maximally activates high-threshold motor units and increases neural drive. After 3-4 minutes of rest (allowing fatigue to dissipate while potentiation persists), the subsequent jump squats benefit from the enhanced neural activation, producing greater power output.
150. A — Velocity-based training uses real-time bar velocity feedback to autoregulate load and volume. Terminating sets when velocity drops 20% below the fastest rep controls fatigue-induced velocity loss, ensuring every repetition maintains movement quality and maximal intent. This prevents grinding through slow, degraded reps that provide suboptimal power and RFD stimulus.
151. C — Progressive single-leg balance challenges on increasingly unstable surfaces restore the proprioceptive function and neuromuscular control disrupted by knee ligament injury. Beginning on stable surfaces and progressing to unstable conditions systematically rebuilds the joint's ability to detect and respond to perturbations, reducing recurrent injury risk during return to sport.
152. D — In-season programming should include 2 sessions per week with reduced volume (2-3 sets rather than 4-5) but maintained intensity on key compound lifts (80-85%+ 1RM). Research consistently demonstrates that intensity is the most critical variable for preventing detraining when volume and frequency must be reduced to accommodate competition demands.
153. B — The interference effect occurs when concurrent strength and endurance training produces suboptimal adaptations compared to training each independently. Separating sessions by 6-8 hours minimizes this interference. When both must occur the same day, performing strength before endurance preserves the quality of the strength stimulus.
154. A — Wrestling matches consisting of three 2-minute periods represent glycolytic-dominant energy demands. Conditioning should use 2-minute high-intensity intervals matching period duration with appropriate rest, developing the specific glycolytic capacity needed for sustained high-intensity grappling across three competitive periods.
155. C — The optimal rest between the heavy conditioning stimulus and the subsequent explosive exercise for PAP is approximately 3-5 minutes. Shorter rest risks residual fatigue masking potentiation. Longer rest risks potentiation dissipating. The 3-5 minute window allows fatigue to clear while neural potentiation from the heavy stimulus remains active.
156. D — Evidence-based tapering involves reducing training volume by 40-60% while maintaining or slightly increasing intensity over 1-3 weeks. This approach allows accumulated fatigue to dissipate

(from volume reduction) while preserving neural and muscular adaptations (from maintained intensity). Complete cessation leads to detraining without the benefit of controlled fatigue management.

157. B — For a fall championship, general preparation should begin in late spring/early summer (approximately May-June) to allow sufficient time for building the broad fitness foundation. Starting earlier provides the 3-5 months needed for systematic progression through general preparation, specific preparation, and competitive peaking phases.
158. A — A "force-deficient" athlete (strong velocity, weak force on the force-velocity profile) needs heavy resistance training at 85%+ 1RM to develop the force production capacity limiting their performance. The athlete already produces high velocity with light loads but lacks the maximal force foundation needed for optimal power expression. Correcting the deficit shifts the entire force-velocity curve upward.
159. C — The 4-phase reconditioning progression (ROM/activation → strength/hypertrophy → power/speed → sport-specific integration) reflects systematic rebuilding from tissue healing through progressive functional restoration to full sport-specific readiness. Each phase builds upon the adaptations established in the preceding phase, ensuring demands never exceed current structural and functional capacity.
160. D — Linear periodization is characterized by progressive increases in intensity with corresponding decreases in volume across sequential mesocycles. The typical progression moves from high-volume, moderate-intensity phases through moderate-volume, high-intensity phases to low-volume, very-high-intensity peaking phases, with each building on the preceding phase's adaptations.
161. B — Block periodization sequences three concentrated training blocks: accumulation (high volume at moderate intensity for work capacity), transmutation (higher intensity for sport-specific strength and power), and realization (low volume at very high intensity for peaking). Each block concentrates on targeted qualities that build upon the adaptations of the preceding block.
162. A — Maintaining intensity at training levels while reducing volume and frequency preserves the neural and muscular stimulus needed for strength and power maintenance during the competitive season. Research consistently demonstrates that intensity is the single most critical detraining-prevention variable — volume and frequency can be substantially reduced without strength loss as long as intensity is preserved.
163. C — The transition period provides 2-4 weeks of unstructured, low-intensity active recovery for physical restoration from accumulated competition fatigue, psychological renewal of motivation, treatment of minor nagging injuries, and mental preparation for the next training cycle.
164. D — Jump squat peak power occurs at 0-30% of back squat 1RM where lighter loading allows the high contraction velocities needed to maximize the velocity component of the power equation.

Heavier loads increase force but reduce velocity below the threshold for peak power expression, resulting in lower overall power output.

165. B — The hang clean achieves peak power at approximately 70-80% of 1RM because sufficient mass is needed for meaningful force production while the ballistic nature of the exercise maintains velocity high enough for peak power expression. The balance between adequate mass and maintained velocity at this loading range produces optimal power output.
166. A — The 48-72 hour recovery requirement between plyometric sessions allows adequate recovery of musculotendinous structures experiencing significant eccentric loading. Tendons and connective tissues have lower metabolic activity and blood supply than muscle, requiring more time for collagen synthesis and structural remodeling. Insufficient recovery increases overuse injury risk from repeated high-impact loading.
167. C — Progressive intensity increases (70% → 78% → 83% → 89%) with corresponding volume decreases (4×8 → 4×6 → 4×5 → 4×3) across sequential phases is the defining characteristic of linear periodization. Each phase builds on the preceding one, systematically progressing from higher-volume, moderate-intensity training toward lower-volume, higher-intensity preparation for peak performance.
168. D — Combining heavy strength training (85%+ 1RM) on some days with explosive exercises (Olympic lifts, plyometrics, jump squats at 30-50% 1RM) on other days addresses both ends of the force-velocity continuum within the same training week. Heavy loads develop maximal force, while explosive exercises develop high-velocity power — both essential for sprint and power sport performance.
169. B — The deload manages accumulated fatigue from loading weeks while maintaining the neuromuscular stimulus through preserved training intensity. The approximately 40% volume reduction allows recovery and supercompensation — the body's adaptive overshoot above the previous fitness level — preparing the athlete for productive training during the subsequent loading cycle.
170. A — This comprehensive combination addresses all identified needs: rowing-specific aerobic conditioning for endurance, barbell rows and pull-ups for pulling strength, anti-extension and anti-rotation core exercises for trunk stability during the rowing stroke, and front squats and Romanian deadlifts for the lower body drive power that initiates each stroke.
171. C — Three-minute rounds of sustained high-intensity fighting fall within the glycolytic-dominant range. The glycolytic system provides primary ATP during each round, while the phosphagen system powers individual explosive techniques (punches, kicks, takedowns), and the aerobic system supports recovery during 1-minute rest periods between rounds.
172. D — Training intensity (percentage of 1RM) is the most critical variable for preventing in-season strength detraining. Research consistently demonstrates that when volume and frequency must be

reduced to accommodate competition schedules, maintaining intensity at preparatory-period levels preserves the neural and muscular adaptations that underpin strength and power performance.

173. B — The correct annual training plan sequence is: general preparation (building a broad fitness base) → specific preparation (developing sport-specific qualities) → competition (peaking and maintenance) → transition (recovery and restoration). Each period builds systematically upon the preceding one from broad fitness through competitive readiness.
174. A — Four sets of 12 at 70% with 60-second rest is a hypertrophy protocol. The moderate load provides sufficient mechanical tension, the higher repetition range and short rest create metabolic stress (lactate, H<sup>+</sup> accumulation), and the combined stimulus drives the protein synthesis and cellular signaling cascade responsible for muscle growth.
175. C — A decathlete competing in 10 events needs simultaneous development of sprint speed, endurance, jumping power, throwing power, and technical skills. Concurrent training with undulating periodization provides the framework for addressing all qualities in parallel throughout the training year without the concentrated detraining of neglected qualities that sequential models produce.
176. D — Belt squats, leg press, goblet squats with modified grip, and other lower body exercises bypassing conventional barbell grip allow continued lower body training while accommodating the wrist injury. Eliminating all training leads to unnecessary detraining that compromises the athlete's physical readiness.
177. B — A goalkeeper's explosive saves and short sprints (2-5 seconds) are phosphagen-dominant efforts with variable rest. Work-to-rest ratios of 1:8 to 1:12 allow near-complete PCr recovery between explosive efforts, ensuring maximal-quality performance on each action matching the variable, explosive demands of the position.
178. A — General preparation builds a broad foundation of hypertrophy (muscle cross-section), general strength (multi-joint force production), work capacity (training volume tolerance), and aerobic fitness (cardiovascular base). This foundation supports the more specific, intense training during subsequent phases.
179. C — Specific preparation shifts training emphasis to sport-specific qualities: explosive power, maximum speed, agility and change-of-direction ability, and sport-specific metabolic conditioning. Exercise selection becomes targeted toward the demands identified in the needs analysis, and methods more closely replicate competitive conditions.
180. D — DUP provides frequent exposure to different training stimuli within each week (hypertrophy Monday, strength Wednesday, power Friday), preventing the accommodation that occurs with prolonged exposure to a single zone. This allows simultaneous development of multiple physical qualities — the primary advantage over linear models addressing each quality sequentially.

181. B — Lacrosse's 60-minute games with mixed physical demands require aerobic base training (sustained play endurance), anaerobic interval training (repeated sprint ability with sport-specific rest), and change-of-direction conditioning (direction changes responding to game situations). Each component addresses specific competitive demands.
182. A — Return-to-play protocols require objective performance criteria: bilateral strength and functional symmetry within 10%, demonstrated competency in sport-specific movements, and formal medical clearance. Subjective reports alone are insufficient because persistent asymmetries exceeding 10% are associated with elevated re-injury risk that objective testing can detect.
183. C — Wave loading exploits post-activation potentiation — the heavier loads in each wave prime the nervous system for enhanced performance on subsequent sets. The first wave progressively activates high-threshold motor units. The second wave begins at loads the nervous system is better prepared to handle due to potentiation from the first wave.
184. D — A "velocity-deficient" athlete (strong force, weak velocity) needs light-load, high-velocity training to develop the velocity component limiting their performance. Plyometrics, jump squats at 30-40% 1RM, and sprint work train the neuromuscular system to produce force rapidly — directly addressing the speed deficit while the existing force capacity provides the foundation.

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

185. B — The vertical jump (CMJ) using a Vertec is the most practical test for this scenario — it is valid (directly measures lower body explosive power), reliable (produces consistent results), practical for large groups (50 athletes in 2 hours), and requires minimal equipment. Multiple athletes can be tested efficiently with a single device.
186. A — Reliability is the psychometric property defined by consistent, reproducible scores across repeated administrations under identical conditions. High reliability ensures that observed score changes between testing sessions can be attributed to actual performance improvement rather than measurement variability or procedural inconsistency.
187. C — The 1RM is defined as the last weight successfully lifted with acceptable technique through the full range of motion. The athlete completed 155 kg with proper form but failed at 160 kg, so 155 kg is recorded as the 1RM. Failed attempts are never counted regardless of how close to completion they were.
188. D — The 13 cm difference between the CMJ (67 cm) and SJ (54 cm) reflects stretch-shortening cycle utilization — the contribution of stored elastic energy and stretch reflex from the rapid countermovement enhancing concentric force production. These SSC mechanisms augment the takeoff force beyond what concentric-only contraction can produce in the static jump.
189. B — The 20-meter beep test requires only cones and a sound system, can be administered to large groups simultaneously, and provides valid aerobic capacity estimates through an externally paced,

progressive-intensity protocol. Its practical advantages make it optimal for the described outdoor, large-group testing scenario.

190. A — The skinfold calculation involves two sequential steps: skinfold thicknesses are entered into population-specific prediction equations to estimate body density, then body density is converted to body fat percentage using equations such as the Siri formula. Both steps are required — skinfold measurements do not directly produce body fat percentage.
191. C — BIA accuracy is most significantly affected by the athlete's hydration status because water is the primary conductor of electrical current in the body. Dehydration increases impedance and overestimates body fat, while hyperhydration decreases impedance and underestimates it — potentially by several percentage points. Consistent hydration protocols are essential for reliable BIA results.
192. D — Electronic timing eliminates human timer reaction variability of approximately 0.1-0.3 seconds per measurement. In short sprints (10-40 yards), this error represents a substantial proportion of total sprint time and may obscure real performance differences between athletes. Electronic systems provide consistent, bias-free timing.
193. B — A 22% bilateral asymmetry substantially exceeds the commonly cited 10-15% clinical threshold for acceptable bilateral difference. This magnitude of asymmetry warrants targeted corrective programming with unilateral exercises emphasizing the weaker limb and possible medical evaluation to identify underlying pathology contributing to the persistent deficit.
194. A — The vertical jump at the 29th percentile is disproportionately low relative to the 87th percentile squat, indicating a rate of force development deficit. The athlete has adequate maximal strength but cannot express it rapidly during the brief ground contact of a jump. Programming should prioritize explosive training modalities — plyometrics, Olympic lifts, and jump squats.
195. C — Using identical testing conditions across sessions — same warmup protocol, equipment, test order, time of day, environmental conditions, and verbal instructions — is the most critical standardization factor for valid longitudinal comparisons. Any variation introduces confounding variables that may be incorrectly interpreted as performance changes.
196. D — At 85% bilateral symmetry, the surgical leg has not met the commonly cited 90% threshold required for return-to-play consideration following ACL reconstruction. Continued progressive strengthening is necessary because persistent asymmetries below 90% are associated with elevated re-injury risk during competitive sport participation.
197. B — Force plates measure peak ground reaction force, rate of force development, impulse (force × time), and power output in addition to jump height. This comprehensive biomechanical data enables detailed performance analysis impossible with simpler methods — the Vertec measures only reach height, and jump mats measure only flight time.

198. A — The sit-and-reach primarily measures hamstring and lower back flexibility, does not assess range of motion at other joints, and is influenced by the athlete's limb proportions (arm-to-leg-to-trunk ratio). For comprehensive flexibility evaluation or identification of specific joint restrictions, goniometric assessment provides superior diagnostic specificity.
199. C — Goniometry provides joint-specific range of motion measurements at any individual joint in the body, allowing precise identification of specific restrictions that the sit-and-reach cannot detect. This specificity enables targeted intervention — if goniometry reveals a specific joint limitation, exercises can be prescribed to address that exact restriction.
200. D — Testing at the beginning and end of each major training phase and at pre/post-season time points provides sufficient data for tracking longitudinal progress, evaluating program effectiveness, and identifying persistent deficiencies — all without excessive disruption to the training schedule from overly frequent testing sessions.
201. B — Submaximal 1RM prediction equations are most accurate when repetitions fall within 10 or fewer because the relationship between submaximal repetitions and true 1RM becomes increasingly non-linear at higher counts. At rep ranges above 10, muscular endurance, pain tolerance, and psychological motivation introduce error the equations cannot account for.
202. A — The standardized 1RM protocol includes 3-4 progressively heavier warmup sets at approximately 50%, 70%, and 80-85% of estimated 1RM before maximal attempts. This progressive loading systematically prepares the neuromuscular system, increases tissue temperature, and rehearses the movement pattern at incrementally higher intensities.
203. C — The T-test includes forward sprint, lateral shuffle in both directions, and backward run arranged in a T-shaped pattern covering approximately 40 total yards. It assesses multidirectional movement ability including forward, lateral, and backward capabilities — a practical field test for team sport athletes.
204. D — If plyometric training alone hasn't improved vertical jump after 12 weeks, the athlete's squat at 1.2× body weight falls below the commonly recommended 1.5× threshold for plyometric effectiveness. Heavy resistance training should be added to develop the strength foundation that enables plyometrics to produce further power gains.
205. B — Both the Cooper 12-minute run and 1.5-mile run require self-pacing at maximal effort for the entire duration. Performance depends heavily on motivation, pacing experience, and willingness to tolerate sustained discomfort. Athletes unfamiliar with self-pacing strategies may produce results significantly underestimating their true aerobic capacity.
206. A — A comprehensive pre-season basketball battery should assess aerobic capacity, sprint speed, agility/change of direction, lower body power, upper body strength, and body composition — domains aligning with basketball's diverse physical demands across four quarters of competition.

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

207. C — Using the NSCA upper guideline of 60 sq ft per athlete:  $60 \text{ athletes} \times 60 \text{ sq ft} = 3,600$  square feet. This ensures adequate space for safe movement, equipment clearance, emergency access, and supervision visibility during training sessions accommodating the full athlete population.
208. D — Emergency action plans should be rehearsed at least annually with all staff members participating, and ideally more frequently. Unrehearsed plans fail under the stress of actual emergencies because staff may not know their assigned roles, equipment locations, communication procedures, or facility access routes for EMS.
209. B — CPR and AED certification from a recognized provider ensures every CSCS-credentialed professional can provide immediate life-saving intervention for cardiac emergencies in the training environment. Cardiac arrest survival rates decline approximately 7-10% for every minute without CPR and defibrillation, making this competency non-negotiable.
210. A — The standard of care is the degree of care, skill, and diligence that a reasonably competent professional with similar training, education, and experience would exercise under similar circumstances. It represents the minimum expected level of professional competence that the profession considers acceptable for safe and effective practice.
211. C — A signed waiver generally does not protect against claims of gross negligence or reckless conduct — willful disregard for participant safety that substantially exceeds ordinary carelessness. While waivers document that inherent risks were disclosed and voluntarily assumed, they cannot absolve professionals of liability for conduct so far below the standard of care as to constitute recklessness.
212. D — Diagnosing musculoskeletal conditions and prescribing rehabilitation exercises are functions entirely outside the CSCS scope of practice, requiring the training and licensure of medical professionals. The specialist must refer to a physician, athletic trainer, or physical therapist for appropriate clinical evaluation and treatment planning.
213. B — The CSCS scope encompasses designing periodized annual training programs, teaching proper exercise technique, administering standardized performance assessments, and managing the strength and conditioning facility. Diagnosing injuries, prescribing rehabilitation, creating individualized meal plans, and providing psychological counseling all require separate professional credentials.
214. A — Equipment showing damage must be immediately removed from service, tagged as out of order, documented in the maintenance log with a description of the issue, and repaired or replaced before returning to use. Continued use of damaged equipment violates the duty to maintain a safe training environment and creates unacceptable liability exposure.
215. C — The NSCA professional standards require the CSCS to decline implementing practices that conflict with evidence-based safety principles, explain the scientific rationale to the sport coach,

and advocate for athletes' safety and wellbeing. The certified professional holds ultimate responsibility for the strength and conditioning program.

216. D — Supervision ratios should adjust based on three primary factors: exercise complexity (Olympic lifts need closer supervision than machines), athlete experience level (novices require more guidance and monitoring), and staff qualifications (more experienced staff can safely manage larger groups).
217. B — Comprehensive records include athlete training logs, performance testing data, signed liability waivers, medical clearance forms, equipment maintenance records, and incident/injury reports. These documents support programming decisions and provide legal documentation of standard of care compliance.
218. A — An unqualified colleague teaching heavy power cleans to novice athletes creates significant safety and liability risk. The concern must be addressed immediately through professional channels — discussing directly with the colleague and escalating to supervisory staff if necessary to ensure technically demanding exercises are taught only by qualified personnel.
219. C — Footwear policies requiring closed-toe athletic shoes protect athletes from dropped weights and equipment contact. Open-toed sandals provide zero protection. The policy must be enforced consistently — the athlete cannot train until returning with proper footwear.
220. D — The NSCA professional standards establish that the CSCS holds ultimate professional authority and responsibility for the design, implementation, and supervision of the strength and conditioning program. While collaboration with sport coaches is essential, the certified professional makes final program decisions based on specialized expertise in exercise science and athlete safety.