PRACTICE EXAM 10: 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 collegiate football running back reveals 40% Type I, 40% Type IIa, and 20% Type IIx fibers. After 24 weeks of combined heavy squats and sprint training, the repeat biopsy will most likely show which change in the Type IIx proportion?

A. An increase in Type IIx from conversion of Type I fibers

B. A decrease in Type IIx with a corresponding increase in Type IIa

C. Complete conversion of all Type IIx to Type I fibers

D. No change because fiber composition is permanently fixed

2. During excitation-contraction coupling, the T-tubules carry the action potential from the sarcolemma to the interior of the fiber. This signal triggers calcium release from which organelle?

A. The mitochondria

B. The Golgi apparatus

C. The myosin filament

D. The sarcoplasmic reticulum

3. A novice lifter increases bench press 1RM by 38% in 6 weeks with only 2% pectoral hypertrophy. This disproportionate strength gain is primarily explained by which adaptation?

A. Sarcoplasmic fluid accumulation

B. Myofibrillar protein degradation

C. Neural improvements in recruitment, rate coding, and coordination

D. Connective tissue thickening around the muscle belly

4. The length-tension relationship predicts that a muscle produces maximal force at which sarcomere length?

A. Optimal resting length where actin-myosin overlap allows peak cross-bridge formation

B. Maximally shortened where actin filaments compress against the Z-lines

C. Maximally lengthened where minimal filament overlap exists

D. Any length because force is independent of sarcomere position

5. An athlete squats 90% of 1RM at a slow velocity. A second athlete jump squats 30% of 1RM at high velocity. According to the force-velocity relationship, which athlete trains closer to the maximal force end of the curve?

A. The jump squat athlete because lighter loads allow more cross-bridges

B. Both athletes train at identical positions on the force-velocity curve

C. Neither athlete produces meaningful force at any load

D. The heavy squat athlete because higher loads at slower velocities produce greater force

6. Henneman's Size Principle predicts that high-threshold motor units innervating Type IIx fibers are recruited only when force demands exceed approximately what percentage of maximal voluntary contraction?

A. 10-20% of MVC

B. 30-40% of MVC

C. 80-85% of MVC

D. High-threshold units are recruited first at all loads

7. The stretch-shortening cycle enhances concentric force through three mechanisms. Which of the following is one of those recognized mechanisms?

A. Storage and return of elastic energy in the musculotendinous unit

B. Increased phosphocreatine availability during the eccentric phase

C. Enhanced mitochondrial oxygen delivery during the countermovement

D. Autogenic inhibition from the Golgi tendon organ

8. An exercise physiologist records blood lactate during a graded cycling test: 150W = 1.3 mmol/L, 200W = 1.9 mmol/L, 250W = 5.1 mmol/L, 275W = 8.7 mmol/L. The lactate threshold occurred at approximately which workload?

A. 150 watts

B. Between 200 and 250 watts

C. 275 watts

D. Cannot be determined from these data

9. A 45-second all-out Wingate test produces blood lactate of 17 mmol/L and a 30% power decline. Which energy system dominated this effort?

A. The phosphagen system exclusively

B. Oxidative phosphorylation through fat metabolism

C. Beta-oxidation of intramuscular triglycerides

D. Anaerobic glycolysis

10. During a 4-hour ride at 62% VO_2max, an athlete's RER decreases from 0.86 to 0.76. This shift reflects which metabolic change?

A. Increased anaerobic glycolysis

B. Increased protein catabolism exclusively

C. Increased fat oxidation as glycogen depletes

D. Decreased total metabolic activity

11. The electron transport chain requires which molecule as its final electron acceptor?

A. Oxygen

B. Carbon dioxide

C. NADH

D. Lactate

12. Fat oxidation yields more ATP per molecule than glucose but cannot fuel high-intensity exercise. This limitation exists because of which factor?

A. Fat stores are too small to provide energy

B. Fat oxidation produces ATP too slowly for high-intensity demands

C. Fat cannot enter mitochondria during exercise

D. Fat generates toxic byproducts at high intensities

13. A marathon runner's blood glucose drops to 48 mg/dL after 3.5 hours at 68% VO_2max. The primary cause of the resulting performance decline is which metabolic event?

A. Phosphocreatine depletion from the sustained aerobic effort

B. Hydrogen ion accumulation from anaerobic glycolysis

C. Protein catabolism destroying contractile tissue

D. Glycogen depletion and hypoglycemia

14. Stroke volume plateaus at approximately 40-60% of VO_2max during progressive exercise. Further cardiac output increases depend primarily on which mechanism?

A. Continued ventricular enlargement during the exercise test

B. Progressive decreases in total blood volume

C. Continued heart rate increases via sympathetic activation

D. Increased blood viscosity forcing faster circulation

15. Newton's Third Law states every action has an equal and opposite reaction. During a vertical jump, the athlete pushes down; the ground pushes back up. For upward acceleration, the GRF must exceed which value?

A. The combined weight of the athlete and any external load

B. Only the athlete's body weight without external load

C. Zero Newtons

D. The weight of the barbell alone

16. At which point during a conventional deadlift is the moment arm on the lumbar spine greatest?

A. At full lockout with a vertical torso

B. Near knee height with the torso inclined forward

C. During the initial pull with the bar still on the floor

D. The moment arm is constant throughout the lift

17. The ventilatory threshold corresponds to increased CO_2 production from which buffering process?

A. Phosphocreatine breakdown releasing inorganic phosphate

B. Fat oxidation producing excess metabolic waste

C. Protein deamination releasing ammonia into the bloodstream

D. Bicarbonate buffering of hydrogen ions from glycolysis

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 force

C. 30-60% of maximal force with moderate-to-high velocity

D. Power is equal at all points on the curve

19. An athlete's passive shoulder flexion is 176 degrees; active flexion is 158 degrees. The 18-degree difference reflects which principle?

A. The neuromuscular limits of voluntary effort versus what external force can achieve

B. A structural bone block preventing active motion beyond 158 degrees

C. A complete rotator cuff tear on the involved shoulder

D. Goniometer calibration error of exactly 18 degrees

20. A trained endurance athlete has a resting SV of 112 mL and resting HR of 47 bpm. The resting cardiac output is approximately which value?

A. 112 mL/min

B. Approximately 5,264 mL/min

C. 47 mL/min

D. 10,528 mL/min

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

A. Permanent vessel closure to the brain and organs

B. Decreased cardiac output concentrating available blood

C. Increased blood viscosity forcing flow to active tissue

D. Local metabolic vasodilation plus sympathetic vasoconstriction in non-essential organs

22. A protocol of 4×10 at 70% 1RM with 60-second rest produces greater acute GH than 5×2 at 93% with 5-minute rest. The primary stimulus for this GH difference is which factor?

A. Heavier absolute loads in the high-volume protocol

B. Greater total training time in the strength protocol

C. Higher metabolic stress from short rest periods

D. Superior neural recruitment from the lighter loads

23. Testosterone levels in males are approximately 10-15 times higher than in females. Female athletes still achieve significant strength gains primarily through which mechanism?

A. Neural adaptations including recruitment, rate coding, and coordination

B. Greater growth hormone production compensating for lower testosterone

C. Enhanced flexibility contributing directly to force production

D. Superior bone mineral density increases replacing hypertrophy

24. An athlete's T:C ratio has declined for 8 consecutive weeks alongside performance stagnation, insomnia, and elevated resting HR. This presentation is most consistent with which condition?

A. Optimal competitive peaking

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

B. Recumbent cycling at low intensity

C. Seated machine exercises with light loads

D. Ground-based resistance exercises with compressive and impact forces

26. Two athletes share a 190 kg squat 1RM. Athlete A jumps 71 cm; Athlete B jumps 53 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 and power in Athlete A

D. Greater flexibility in Athlete A

27. During the acceleration phase of a sprint, a forward body lean allows the athlete to direct GRF in which direction?

A. Primarily horizontally to generate forward momentum

B. Primarily vertically to maximize flight time

C. Mediolaterally for balance

D. Body lean has no effect on force direction

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

A. The anteroposterior component

B. The vertical component

C. The mediolateral component

D. All three components equally

29. Chronic heavy training modifies GTO function by producing which specific change?

A. Increasing GTO sensitivity to activate at lower thresholds

B. Completely eliminating all GTOs from the tendon

C. Having no measurable effect on GTO function

D. Reducing GTO inhibition so athletes can produce force closer to structural capacity

30. An athlete's CMJ is 66 cm and SJ is 54 cm. The 12 cm difference represents the contribution of which mechanism?

A. Greater phosphocreatine in the CMJ

B. Enhanced aerobic energy during the countermovement

C. The stretch-shortening cycle

D. Reduced bodyweight at the transition point

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

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

B. Force amplification at the expense of speed

C. Equal force and speed at all joint angles

D. Zero mechanical advantage in any direction

32. An athlete has trained with the same program for 22 weeks and strength gains have plateaued. According to the principle of accommodation, the best intervention is which of the following?

A. Continue the identical program indefinitely

B. Complete training cessation for 6 months

C. Permanently reduce all loads to 30% 1RM

D. Introduce variation in exercises, loads, or periodization model

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

A. Identical metabolic activity to muscle tissue

B. Lower metabolic activity and blood supply

C. Higher metabolic activity than muscle tissue

D. No capacity for structural remodeling

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

A. Only aerobic endurance is needed for volleyball

B. Slow jogging provides all volleyball-specific adaptations

C. Explosive jumping, lateral agility, overhead power, and anaerobic capacity

D. Only flexibility is relevant to volleyball performance

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

A. Supramaximal eccentric training with loads exceeding concentric 1RM

B. Elimination of all eccentric training due to injury risk

C. Identical loading for eccentric and concentric phases

D. Eccentric-only training producing zero force at all velocities

36. Detraining research shows which quality declines most rapidly?

A. Maximal strength within 24 hours

B. Bone mineral density within 5 days

C. Flexibility within 48 hours

D. Aerobic capacity within 1-2 weeks

37. An athlete calculates torque during a lateral raise: 7 kg dumbbell, arm extended at 90° abduction, 0.58 m from shoulder to dumbbell center. The torque is approximately which value?

A. 7 N·m

B. Approximately 39.8 N·m

C. 0 N·m

D. 150 N·m

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

A. Increased blood viscosity maintaining constant pressure

B. Vasoconstriction in all vascular beds simultaneously

C. Vasodilation in working muscles reducing peripheral resistance

D. Decreased cardiac output during diastole

39. A female distance runner presents with amenorrhea for 8 months, caloric intake of 1,200 kcal/day with 2.5 hours daily training, and decreased lumbar BMD. This presentation indicates which condition?

A. Relative Energy Deficiency in Sport (RED-S)

B. Iron deficiency anemia

C. Normal endurance training adaptation

D. Vitamin D toxicity

40. Cortisol's acute catabolic actions during exercise include which metabolic function?

A. Stimulating protein synthesis through mTOR

B. Enhancing muscle glycogen synthesis

C. Suppressing all lipolysis during exercise

D. Protein degradation and gluconeogenesis

41. An athlete's post-16-week blood work shows stable testosterone, decreased cortisol, improved T:C ratio, continued performance gains, and 8+ hours of nightly sleep. This indicates which status?

A. Advanced overtraining syndrome

B. Successful positive adaptation

C. Underlying medical condition

D. Irrelevant hormonal data

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

A. No effect on the muscle's hormonal response

B. Eliminates the need for sleep and nutrition

C. Enhanced muscle sensitivity to circulating testosterone

D. Reverses within 24 hours of training cessation

43. An exercise physiologist monitors RER during progressive cycling: 30% VO_2max = 0.76, 60% = 0.87, 85% = 0.99, 95% = 1.12. The increase from 0.76 to 0.99 describes which concept?

A. The crossover from fat to carbohydrate dominance

B. A shift toward exclusive protein oxidation

C. Decreased metabolic activity with increasing intensity

D. A constant metabolic rate at all intensities

44. The Cori cycle recycles lactate from muscles to the liver and back as glucose. This pathway is important because it serves which function?

A. Permanently removing lactate as toxic waste

B. Converting lactate into fatty acids for storage

C. Transforming lactate into amino acids for MPS

D. Maintaining blood glucose for the brain and working muscles

45. The phosphagen system's speed advantage comes from which characteristic of the creatine kinase reaction?

A. It requires complex mitochondrial processing

B. It is a simple single-step reaction in the sarcoplasm requiring no oxygen

C. It operates exclusively within the mitochondrial matrix

D. It requires oxygen as an essential co-factor

46. The calf raise exemplifies a second-class lever. This arrangement favors which outcome?

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

B. Equal emphasis on force and speed

C. Force production because the effort arm exceeds the resistance arm

D. Zero mechanical advantage in any direction

47. Muscle spindles detect length changes and produce which reflex during plyometric landing?

A. The stretch reflex, augmenting concentric force during the SSC

B. The withdrawal reflex, pulling the limb away from danger

C. Autogenic inhibition reducing muscle tension

D. The crossed-extensor reflex extending the contralateral limb

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

A. Permanently elevated creatine kinase enzyme levels

B. Increased circulating testosterone persisting indefinitely

C. Residual glycogen stores lasting years after detraining

D. Retained myonuclei from prior training accelerating retraining responses

49. During a depth jump, if the amortization phase exceeds 250 ms, what happens to SSC benefit?

A. The stretch reflex is amplified

B. Elastic energy dissipates as heat and the reflex contribution diminishes

C. Concentric force is unaffected

D. The musculotendinous unit becomes stiffer

50. A strength and conditioning specialist evaluates two athletes on a force plate. Both produce 2,900 N peak GRF at 85 kg body weight. Athlete A reaches peak in 140 ms; Athlete B in 270 ms. Which athlete jumps higher?

A. Athlete B due to longer force application time

B. Both jump identically because peak force is equal

C. Athlete A due to superior rate of force development

D. Jump height cannot be predicted from force data

51. PNF contract-relax stretching exploits which proprioceptor mechanism?

A. GTO autogenic inhibition reducing muscle tone after isometric contraction

B. Muscle spindle facilitation increasing contraction force

C. Pacinian corpuscle vibration detection during the stretch

D. Ruffini ending pressure detection at the joint capsule

52. A 16-week study tracks a novice and an experienced lifter on identical programs. The novice gains 45% strength with minimal hypertrophy; the experienced lifter gains 3% with measurable hypertrophy. This demonstrates which principle?

A. Both athletes should produce identical adaptation rates

B. The novice is using performance-enhancing substances

C. Hypertrophy always precedes neural adaptation

D. Diminishing returns and the neural-to-structural adaptation shift

SPORT PSYCHOLOGY (Questions 53–75)

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

A. Somatic anxiety

B. Cognitive anxiety

C. Trait anxiety that cannot be modified

D. Facilitative arousal

54. According to the inverted-U hypothesis, a maximal deadlift benefits from which arousal level?

A. Very low arousal for complete relaxation

B. Moderate arousal identical to precision shooting

C. Irrelevant because arousal does not affect strength

D. Relatively high arousal for maximal recruitment

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

A. Outcome, performance, and process goals in a hierarchical structure

B. Only outcome goals without intermediate targets

C. Only process goals without long-term direction

D. No goals because goal-setting decreases motivation

56. Self-efficacy differs from general self-confidence because it is which of the following?

A. A global personality trait applying equally to all tasks

B. Determined exclusively by genetics

C. Identical to general confidence in every respect

D. Task-specific and situation-specific

57. An athlete watches a teammate of similar ability complete a challenging lift. This increases the observer's belief they can also succeed. Which self-efficacy source is responsible?

A. Past performance accomplishment

B. Verbal persuasion from the coach

C. Physiological state interpretation

D. Not determinable from this information

58. A coach tells an athlete: "Your elbow dropped during that clean catch." This feedback is classified as which type?

A. Knowledge of results about the lift outcome

B. Intrinsic feedback from the athlete's senses

C. Knowledge of performance about movement quality

D. Motivational feedback to increase effort

59. The contextual interference effect predicts that random practice produces which learning outcome compared to blocked practice?

A. Slower initial improvement but better long-term retention

B. Faster initial improvement and better long-term retention

C. Identical outcomes regardless of practice structure

D. Faster initial improvement with identical long-term retention

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

A. Optimal permanent learning from maximum information

B. Accelerated mastery persisting indefinitely

C. No measurable effect on skill acquisition

D. Impaired learning from dependency on external correction

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

A. Large frequent errors with heavy reliance on verbal instruction

B. Automatic execution with attention freed for strategy and monitoring

C. Inability to perform the skill under any conditions

D. Frequent errors requiring conscious attention for every repetition

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

A. Elimination of all performance errors during practice

B. Complete glycogen resynthesis improving cortical function

C. Memory consolidation during rest intervals between practice bouts

D. Massed practice produces zero learning under all conditions

63. An athlete who performs well in practice but underperforms in competition, reporting intense worry and negative self-talk, is experiencing which phenomenon?

A. Choking under pressure from excessive cognitive anxiety

B. Social facilitation enhancing competitive performance

C. Optimal arousal producing best possible output

D. A permanent disorder preventing competitive success

64. Athletic burnout is characterized by which three dimensions?

A. Increased motivation, enthusiasm, and improved performance

B. Normal fluctuations resolving within 24 hours

C. Acute anxiety disappearing immediately after competition

D. Emotional exhaustion, depersonalization, and reduced accomplishment

65. A 16-year-old athlete shows increasing isolation, persistent worthlessness, lost interest in activities, and expressed hopelessness. The specialist should respond by doing which of the following?

A. Designing a more intense training program

B. Recommending parents seek mental health evaluation

C. Increasing the competitive schedule for more success

D. Ignoring the behavior as normal adolescent development

66. A wrestler displays extreme weight manipulation, meal avoidance, and excessive exercise. According to scope of practice, the specialist should do which of the following?

A. Prescribe a detailed meal plan

B. Conduct more frequent body composition testing

C. Refer to a qualified healthcare professional

D. Ignore the signs as normal wrestling behavior

67. Self-determination theory identifies which three basic psychological needs supporting intrinsic motivation?

A. Autonomy, competence, and relatedness

B. Strength, power, and endurance

C. Visual, kinesthetic, and auditory processing

D. Outcome, performance, and process achievement

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

A. Enhanced performance from metabolic efficiency

B. Increased testosterone from adaptive stress

C. No consequences because RED-S affects only females

D. Suppressed testosterone, decreased BMD, impaired immunity, declining performance

69. An athlete returning from ACL surgery fears re-injury during cutting drills despite full clearance. The most appropriate response is which of the following?

A. Immediate return to full-contact competition

B. Gradual reintroduction of movements with sport psychology referral

C. Permanent elimination of all cutting movements

D. Dismissing psychological concerns as irrelevant

70. Research on injury psychology consistently shows that athletes with significant rehabilitation distress have which outcome?

A. Identical recovery to well-adjusted athletes

B. Faster recovery from the motivational effect of distress

C. Longer recovery times and higher re-injury rates

D. Improved mental toughness from the injury experience

71. An athlete successfully squats 185 kg for the first time and reports increased confidence for 190 kg. Which self-efficacy source is primarily responsible?

A. Past performance accomplishment

B. Vicarious experience from a teammate's lift

C. Verbal persuasion from the coaching staff

D. Physiological state interpretation

72. A point guard scanning the entire court for open teammates uses which attentional focus in Nideffer's model?

A. Narrow-internal

B. Narrow-external

C. Broad-internal

D. Broad-external

73. 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. Overall speed and absolute force of execution

C. Fundamental spatial pattern of the throw

D. Nothing because the GMP cannot be modified

74. Somatic anxiety symptoms (muscle tension, elevated HR, rapid breathing) are best addressed by which intervention?

A. Thought stopping and cognitive restructuring

B. Goal-setting worksheets

C. Physical relaxation techniques (PMR, diaphragmatic breathing)

D. Imagery focused on worst-case scenarios

75. Front squats develop the upright torso and high-elbow rack position that transfers to the power clean catch. This is an example of which type of transfer?

A. Positive transfer

B. Negative transfer

C. Zero transfer

D. Random unpredictable transfer

NUTRITION (Questions 76–95)

76. A 100 kg strength athlete at 2.2 g/kg/day requires which daily protein target?

A. 80 grams

B. 150 grams

C. 500 grams

D. 220 grams

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

A. Glutamine

B. Leucine

C. Glycine

D. Alanine

78. An athlete on a very low-fat diet (<15% calories) for 5 months has suppressed testosterone. The most likely cause is which of the following?

A. Excessive protein intake

B. Excessive carbohydrate intake

C. Inadequate fat impairing steroid hormone production

D. Inadequate water intake

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

A. Exercise-associated hyponatremia from sodium dilution

B. Hypernatremia from excessive sodium concentration

C. Metabolic alkalosis from elevated water pH

D. Rhabdomyolysis from mechanical muscle damage

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

A. 24-48 hours

B. Full saturation is impossible without loading

C. 6-12 months regardless of dose

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 buffering is most beneficial for activities lasting which duration?

A. Less than 5 seconds

B. Longer than 60 minutes

C. 1-4 minutes

D. During complete rest

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

A. NSF Certified for Sport or Informed Sport

B. USDA Organic

C. FDA pharmaceutical approval

D. ISO 9001 manufacturing certification

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

A. General population RDA of 0.8 g/kg

B. Less than 0.5 g/kg

C. No protein needed 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. Gastrointestinal distress (nausea, bloating, diarrhea)

C. Dangerous cardiac arrhythmias

D. Complete energy system suppression

86. A 75 kg endurance athlete at 10 g/kg/day requires which daily carbohydrate target?

A. 75 grams

B. 375 grams

C. 750 grams

D. 1,500 grams

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

A. Impaired muscle function, compromised immunity, elevated stress fracture risk

B. Excessive uncontrollable hypertrophy

C. Enhanced performance from metabolic efficiency

D. No consequences for muscle or bone function

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 Fe^{3+} to more bioavailable 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 response

D. Only protein with zero carbohydrate

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

A. Plant diets cannot provide adequate protein

B. Only soy protein at every meal

C. Consuming complementary plant sources throughout the day

D. 100 grams of isolated BCAAs daily

91. Casein before sleep supports overnight recovery through which mechanism?

A. Sustained amino acid delivery from slow gel-forming digestion

B. Immediate gastric emptying identical to whey

C. Complete catabolic hormone suppression for 48 hours

D. No benefit because pre-sleep protein is wasted

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

A. Only at breakfast regardless of training

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 at all doses

D. Only supplement approved by all anti-doping agencies

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

A. No physiological function; can be eliminated

B. Exclusive phosphagen system fuel during sprinting

C. Hormone production, vitamin absorption, membrane integrity, essential fatty acids

D. Direct Type IIx fiber hyperplasia stimulation

95. The general fluid intake guideline during 90-minute team sport competition is which of the following?

A. 200-300 mL every 15-20 minutes adjusted for sweat rate

B. No fluid because drinking impairs performance

C. 4 liters at halftime in a single bolus

D. Only caffeinated beverages

SECTION 2 — PRACTICAL/APPLIED

125 Questions | 2.5 Hours Recommended

EXERCISE TECHNIQUE (Questions 96–140)

96. Before loading any barbell exercise, a novice athlete should first demonstrate competency in which movement?

A. 1RM back squat at maximum load

B. Barbell overhead press at 80% 1RM

C. Weighted depth jump from a 42-inch box

D. Unloaded bodyweight squat

97. An athlete's heels rise during the squat descent. This most commonly indicates which limitation?

A. Excessive hip flexion mobility

B. Insufficient ankle dorsiflexion

C. Superior quadriceps strength

D. Excessive thoracic extension

98. A deadlift bar drifting forward of the shins increases which biomechanical demand?

A. Decreased lumbar torque from the forward position

B. Improved quadriceps leverage

C. Increased moment arm and flexion torque on the lumbar spine

D. No biomechanical consequence

99. Closed grip (thumbs wrapped) is required during bench press to prevent which hazard?

A. The bar rolling out of the hands onto the chest, neck, or face

B. Bar spinning on its longitudinal axis

C. Excessive triceps activation

D. Forearm muscle imbalances

100. An athlete arches excessively during the overhead press. This compensation creates which concern?

A. Enhanced deltoid activation from the improved angle

B. Improved spinal stability from the extended position

C. No safety concern whatsoever

D. Lumbar compressive/shear forces increasing injury risk

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

A. Full squat clean from the floor

B. The front squat to establish the receiving position

C. Clean pull from the floor without a catch

D. Hang clean at near-maximal loads

102. Premature elbow bending during the power clean second pull reduces the contribution of which muscle group?

A. The biceps brachii

B. The forearm flexors

C. The hip extensors through triple extension

D. The rotator cuff muscles

103. A specialist programs the first plyometric session for athletes with no plyometric experience. The appropriate selection is which of the following?

A. Low-to-moderate intensity exercises at 80-100 foot contacts

B. Depth jumps from 42-inch boxes at 250 contacts

C. Single-leg depth jumps with weighted vests at 200 contacts

D. Weighted jump squats at 60% 1RM for 300 contacts

104. When spotting a back squat with a single spotter, assistance is provided at which location?

A. On the barbell at each end

B. On the athlete's hips

C. On the athlete's shoulders

D. Near the torso with arms under the armpits

105. The Valsalva maneuver is appropriate for which population and context?

A. All populations during every exercise

B. Healthy trained athletes during heavy compound lifts

C. Only during light isolation exercises

D. Individuals with uncontrolled hypertension

106. An athlete rounds the spine during bent-over rows with momentum. The correct response is which of the following?

A. Encourage the momentum for heavier loads

B. Add more weight to challenge the posterior chain

C. Terminate the set, reduce load, cue neutral spine with scapular retraction

D. Switch permanently because rows cannot be performed safely

107. A baseball pitcher needs rotational power and anti-rotation stability. Which combination addresses both?

A. Medicine ball rotational throws and Pallof press variations

B. Only weighted sit-ups

C. Only isometric planks for maximum duration

D. Only heavy Russian twists at maximum velocity

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

A. Trunk rotation

B. Lateral trunk flexion

C. Trunk flexion in the sagittal plane

D. Lumbar hyperextension

109. Running fully upright during sprint acceleration produces which consequence?

A. Enhanced acceleration from greater stride frequency

B. Reduced horizontal GRF impairing acceleration

C. No effect on sprint performance

D. Improved top-end speed compensating for any loss

110. The pro agility shuttle lacks which component that defines true agility?

A. Physical deceleration and reacceleration

B. Multiple direction changes

C. A reactive perceptual-cognitive decision-making component

D. A timing mechanism

111. Dynamic stretching is preferred before explosive exercise because it produces which effect?

A. ROM increase with neuromuscular activation, unlike static stretching which reduces force

B. Permanent muscle fiber destruction

C. Identical effects to static stretching

D. No flexibility benefit

112. Foam rolling before training provides which advantage over static stretching?

A. Permanent fascial restructuring in one session

B. Identical performance decrements to static stretching

C. Reduced ROM compared to no warmup

D. ROM increase without acute force/power decrements

113. A complete warmup should progress in which sequence?

A. Heavy sets → static stretching → cooldown

B. General warmup → dynamic stretching → movement prep → specific progressive loading

C. Static stretching → maximal lifts → dynamic stretching

D. No warmup is necessary

114. Chronic cold water immersion after every resistance session may produce which consequence?

A. Accelerated hypertrophy

B. Enhanced neural adaptation

C. Blunted inflammatory signaling needed for adaptation

D. Improved tendon remodeling

115. The foundational recovery practices are which of the following?

A. Adequate sleep (7-10 hours) and post-exercise nutrition

B. Pneumatic compression for 60 minutes post-session

C. Cryotherapy twice daily

D. Electrical stimulation for 90 minutes nightly

116. Conditioning for a basketball team should include which combination?

A. Exclusively long-distance running at 60% HRmax

B. Only heavy resistance training

C. Only static stretching for 60 minutes

D. Aerobic base, anaerobic intervals, and reactive agility conditioning

117. The aerobic system's most important team sport contribution is which of the following?

A. Directly powering each maximal sprint

B. Recovery between high-intensity bouts

C. Eliminating glycolytic energy production

D. No relevance to team sports

118. Interval training for a football DB (4-6 sec sprints, 25-40 sec rest) should use which ratio?

A. 1:1 targeting the oxidative system

B. 1:3 targeting the glycolytic system

C. 1:5 to 1:8 targeting the phosphagen system

D. No structured rest

119. Tempo running at lactate threshold intensity develops which specific adaptation?

A. Raised lactate threshold to a higher percentage of VO_2max

B. Maximum sprint speed

C. Explosive power

D. Hamstring flexibility

120. Active recovery at <50% HRmax the day after intense training primarily promotes which benefit?

A. Identical training stimulus to high-intensity work

B. Complete soreness elimination within 10 minutes

C. Replacement for sleep

D. Blood flow to recovering tissues and metabolic waste removal

121. Dropped elbows during a front squat produce which immediate consequence?

A. Improved quadriceps activation

B. Bar rolling forward off the deltoids with loss of control

C. Enhanced thoracic extension

D. Increased biceps support of the bar

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

A. Greater patellofemoral compression

B. Increased forward knee translation

C. Elimination of front-leg eccentric deceleration demand

D. Complete elimination of all eccentric action

123. Moving the front foot further from the bench during a Bulgarian split squat reduces knee stress through which mechanism?

A. Creating a more vertical shin angle shifting load to hip extensors

B. Increasing forward knee translation

C. Maximizing patellofemoral compression

D. Shifting center of gravity over the front knee

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

A. Greater lumbar moment arm

B. Identical biomechanics with no difference

C. Increased grip demand from thicker handles

D. Reduced lumbar moment arm from load centered closer to the body

125. During dumbbell spotting, assistance should be applied at which location?

A. On the dumbbells themselves

B. At the wrists near the athlete's hands

C. At the elbows for leverage

D. At the upper arms near the shoulder

126. Banded squats provide maximum resistance at which position?

A. The bottom where the band is least stretched

B. Constant resistance throughout

C. The top where the band is fully stretched

D. The bottom where the athlete is weakest

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

A. Maximal speed with minimal eccentric-to-concentric transition time

B. A 5-second isometric pause between catch and throw

C. Slow controlled tempo for time under tension

D. Maximum weight regardless of speed

128. Olympic platforms should be positioned with which primary consideration?

A. Adjacent to cardio equipment

B. Against mirrors for technique monitoring

C. Center of facility for motivation

D. Separated from traffic with adequate clearance on all sides

129. With 30 athletes and 10 squat racks, the optimal approach is which of the following?

A. All 30 doing bodyweight squats while waiting

B. Groups of 3 per rack rotating squat/spot/rest

C. All 30 watching one demonstration

D. Eliminating squats from the program

130. Barbell collars serve which primary safety purpose?

A. Increasing total barbell weight

B. Improving grip friction

C. Preventing plates from sliding off during exercise

D. Decorative only with no function

131. An athlete's program includes power cleans, back squats, bench press, lat pulldowns, lateral raises, and planks. Which exercise is performed first?

A. Power cleans

B. Planks

C. Lateral raises

D. Lat pulldowns

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

A. Wide pronated grip at the bar ends

B. No grip — hands on elbows for leverage

C. Supinated grip near the weight plates

D. Alternated grip close to center of the bar

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

A. Excessive explosive ability beyond development

B. Maximal strength deficit requiring heavy training (85%+ 1RM)

C. Only aerobic conditioning needed

D. Only flexibility training needed

134. Correct RDL technique includes which combination of standards?

A. Full knee lockout with lumbar rounding

B. Deep knee flexion to 90° in a squat pattern

C. Slight constant knee flexion, neutral spine, hip hinge, bar close to legs

D. Alternating between knee extension and flexion each rep

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

A. Pulling strength, rotator cuff health, and trunk stability

B. Only lower body power

C. Only flexibility

D. Only cardiovascular endurance

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

A. Sagittal extension

B. Sagittal flexion

C. Frontal plane lateral flexion

D. Rotational force attempting to twist the torso

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

A. Only ankle dorsiflexion

B. Overhead squat mobility with locked arms in a deep squat

C. Only wrist flexion

D. No prerequisites — all athletes can perform the snatch safely

138. Correct push-up execution includes which standards?

A. Hips sagging with visible swayback

B. Elbows flared to 90° regardless of comfort

C. Straight line head-to-heels, chest near floor, elbows at ~45°

D. Partial ROM with elbows bending 10-15°

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

A. 5-10 yard sprints with 25-40 second rest

B. Continuous 3-mile runs

C. 400-meter repeats with 60-second rest

D. 60-minute cycling at 50% HRmax

140. Cable face pulls should be set at which height with the athlete pulling toward which target?

A. Floor level pulling toward the knees

B. Above head pulling downward

C. Knee height pulling diagonally across the body

D. Face height pulling toward the face with external rotation and scapular retraction

PROGRAM DESIGN (Questions 141–184)

141. A competitive 800-meter runner (race ~1:50-2:10) relies most heavily on which energy system combination?

A. Exclusively the phosphagen system

B. Glycolytic primary, aerobic secondary, phosphagen for the kick

C. Exclusively oxidative through fat metabolism

D. No specific system is dominant

142. A push jerk is classified as a power exercise because it meets which criteria?

A. Performed on a machine at slow tempo

B. Single-joint isolation of a small muscle group

C. Structural, explosive, involving multiple large muscle groups

D. Identical to a strict press with no explosive component

143. In a session with hang clean, back squat, bench press, pulldown, triceps pushdown, and plank, which exercise is performed first?

A. Hang clean

B. Triceps pushdown

C. Plank

D. Pulldown

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

A. 6 sessions/week using advanced body-part split

B. 1 session/month at maximal loads

C. Daily machine-only sessions at maximum intensity

D. 2-3 sessions/week using total-body training with moderate loads

145. Training at >85% 1RM for ≤6 reps with 2-5 min rest develops which quality?

A. Muscular endurance

B. Maximal strength through neural adaptation

C. Cardiovascular fitness

D. Muscle hypertrophy

146. An athlete's 1RM squat is 170 kg. At 85% 1RM for 5×4, the load is approximately which value?

A. 170 kg

B. 85 kg

C. 144-145 kg

D. 210 kg

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

A. Hypertrophy to maintain metabolic stress

B. Maximal strength requiring full PCr recovery

C. Power requiring complete neural recovery

D. Aerobic endurance conditioning

148. DUP's primary advantage over linear periodization is which of the following?

A. Eliminates need for planning

B. Never uses heavy loads

C. Identical outcomes to constant programming

D. Frequent exposure to different stimuli preventing accommodation

149. Linear periodization is characterized by which pattern?

A. Volume and intensity both increase simultaneously

B. Increasing intensity with decreasing volume across phases

C. Constant volume and intensity throughout

D. Decreasing intensity with increasing volume

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

A. Realization → Transmutation → Accumulation

B. Competition → Transition → General prep

C. Accumulation → Transmutation → Realization

D. Endurance → Flexibility → Cardio only

151. In-season maintenance with reduced volume/frequency but maintained intensity produces which outcome?

A. Strength and power maintenance

B. Dramatic strength loss

C. Significant additional gains

D. Complete detraining within 48 hours

152. The transition period should last approximately how long?

A. 12 weeks of maximal training

B. 6 months of bed rest

C. Eliminated entirely

D. 2-4 weeks of low-intensity active recovery

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

A. 85-95% 1RM

B. 0-30% 1RM allowing high velocity

C. 50-70% 1RM

D. Equal at all loads

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

A. 0-10% 1RM

B. 30-40% 1RM

C. 70-80% 1RM

D. 95-100% 1RM

155. Beginner plyometric volume should be which of the following?

A. 80-100 foot contacts across varied intensity

B. 250 contacts of depth jumps only

C. 500 contacts to maximize stimulus

D. 10 contacts regardless of type

156. Plyometrics should be positioned when in a training session?

A. After heavy resistance training for maximum fatigue

B. Only on rest days with no activity for 72 hours

C. After a 5K run to simulate game fatigue

D. After warmup when the athlete is fresh

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

A. Insufficient maximal strength

B. A rate of force development deficit requiring explosive training

C. No deficiency

D. Excessive flexibility

158. Soccer conditioning (90-min matches) should include which combination?

A. Only heavy resistance training

B. Only long-distance running

C. Aerobic base, anaerobic intervals, and reactive agility

D. Only static stretching

159. The transition period should focus on which objectives?

A. Physical and psychological recovery for 2-4 weeks

B. Maximal intensity for next season

C. 6 months of complete rest

D. New sports the athlete never practiced

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

A. Subjective report of readiness only

B. Walking without a limp as sole criterion

C. Any group exercise class

D. Bilateral symmetry within 10%, movement competency, and medical clearance

161. An ice hockey forward (45-60 sec shifts, 2-3 min rest) should target which energy system?

A. Only the phosphagen system

B. The glycolytic system with matching interval training

C. Only the oxidative system

D. No energy system training needed

162. For an advanced athlete preparing for a single competition, which model is best?

A. Fixed program with no variation

B. Beginner program at 60% 1RM

C. Block periodization targeted to peak at competition

D. Random exercise selection

163. After 22 weeks on the same program with plateau, the best intervention is which of the following?

A. Introduce variation in exercises, loads, or periodization

B. Continue identical program indefinitely

C. Cease training for 6 months

D. Reduce all loads to 25% permanently

164. Hamstring reconditioning after surgery should follow which progression?

A. Immediate full-intensity sprinting on day one

B. Exclusive upper body training permanently

C. Rest for 12 additional months regardless of clearance

D. Progressive loading meeting bilateral symmetry (within 10%) before return

165. A 12-week powerlifting block periodization sequences blocks in which order?

A. Realization → Transmutation → Accumulation

B. Accumulation → Transmutation → Realization

C. Flexibility → Cardio → Endurance

D. Competition → Transition → General prep

166. Muscular endurance rest periods (<67% 1RM, 12+ reps) should be which duration?

A. 2-5 minutes for full recovery

B. 8-10 minutes

C. 30 seconds or less

D. No rest for 90 minutes continuously

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

A. Maximal strength and neural adaptation

B. Muscular endurance

C. Hypertrophy

D. Cardiovascular fitness

168. Volume load for 5×5×140 kg equals which total?

A. 700 kg

B. 25 reps

C. 1,400 kg

D. 3,500 kg

169. A novice's first 4-6 weeks should use which loading strategy?

A. 95% 1RM singles from day one

B. Moderate loads (60-70% 1RM) with 10-15 reps emphasizing technique

C. Only plyometric depth jumps

D. No resistance training for 12 months

170. Plyometric frequency of 2-3 sessions/week with 48-72 hours between is primarily for which reason?

A. Arbitrary with no basis

B. Cognitive processing only

C. Musculotendinous recovery from eccentric loading

D. Cardiovascular restoration exclusively

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

A. Linear periodization

B. Block periodization

C. Random programming

D. Daily undulating periodization

172. 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 on some days, explosive exercises on others

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

A. 1RM testing under fatigue

B. Managing fatigue while maintaining stimulus for supercompensation

C. Permanent load reduction

D. Program restart from the beginning

174. A rower's needs (endurance, pulling strength, core, lower body drive) are best addressed by which combination?

A. Only distance running and cycling

B. Only biceps curls

C. Only depth jumps

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

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

A. The glycolytic system supplemented by phosphagen and aerobic

B. Only the phosphagen system

C. Only the oxidative system

D. No energy system training needed

176. 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)

177. 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

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

A. Maximal strength with heavy loading

B. Explosive ballistic power

C. Muscle hypertrophy

D. Phosphagen system development

179. A decathlete needs simultaneous sprint, endurance, jump, throw, and skill development. Which model is best?

A. Concurrent training with undulating periodization

B. Block periodization on one event for 4 weeks

C. Only sprinting for 6 months then only throwing

D. No structured training

180. 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

181. 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

182. General preparation emphasizes which qualities?

A. Sport-specific power and speed immediately

B. Complete rest for the entire phase

C. Broad base of hypertrophy, strength, work capacity, and aerobic fitness

D. Only technical skill practice

183. Specific preparation shifts emphasis to which focus?

A. Sport-specific power, speed, agility, and conditioning

B. Maximum aerobic endurance only

C. Complete rest

D. Only flexibility

184. 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

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

B. Vertical jump (CMJ) with Vertec

C. Force plate with 3D motion capture

D. Underwater weighing

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

A. Face validity

B. Construct validity

C. Reliability

D. Criterion validity

187. During 1RM testing, an athlete lifts 150 kg successfully then fails at 155 kg. The 1RM is which value?

A. 150 kg

B. 155 kg

C. 152.5 kg

D. Test must restart

188. An athlete's CMJ = 65 cm, SJ = 53 cm. The 12 cm difference reflects which capacity?

A. Maximum aerobic power

B. Absolute quadriceps strength

C. Hamstring:quadriceps ratio

D. Stretch-shortening cycle utilization

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

A. Lab treadmill VO_2max

B. 20-meter beep test

C. Wingate on cycle ergometer

D. 1RM back squat

190. Skinfold assessment uses which two-step calculation?

A. Skinfolds directly produce body fat percentage

B. Skinfolds estimate bone density only

C. Skinfolds → prediction equations → body density → Siri equation → body fat %

D. Skinfolds × body weight = fat mass

191. BIA accuracy is most affected by which variable?

A. The athlete's hydration status

B. Room temperature

C. Shoe brand

D. Number of people present

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

A. Wind resistance

B. Temperature effects on muscle

C. Lane marking color

D. Human timer reaction variability (0.1-0.3 sec)

193. A bilateral hop test shows: R=44 cm, L=35 cm (~20% asymmetry). This suggests which finding?

A. Normal variation

B. Clinically significant asymmetry exceeding 10-15% threshold

C. Right leg overtrained

D. Invalid test

194. Test results: squat=85th, VJ=31st, agility=57th, 1.5-mile=62nd. Highest priority is which quality?

A. Maximal strength

B. Aerobic endurance

C. Explosive power (VJ at 31st — disproportionately low vs. strength)

D. Agility

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

A. Identical conditions across sessions

B. Different tests each time

C. Athlete-selected conditions

D. Testing after heavy training

196. An ACL reconstruction patient achieves 87% 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

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

D. Only flight time

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

A. Requires expensive lab equipment

B. Takes 30+ minutes per athlete

C. Measures only hamstring/lower back flexibility; influenced by limb proportions

D. Measures only shoulder flexibility

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

A. Joint-specific ROM at any joint, identifying specific restrictions

B. Less accurate than sit-and-reach

C. Identical information with no additional value

D. Limited to hip measurement only

200. Testing should occur at which intervals?

A. Daily

B. Once at career start only

C. Randomly

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 before maximal attempts?

A. None — attempt 1RM immediately

B. One set of 50 light reps

C. 3-4 progressively heavier sets (~50%, 70%, 80-85% 1RM)

D. 10 sets of 10 reps

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

A. Forward sprint, lateral shuffles, backward run in a T-shape

B. Straight 40-yard sprint

C. 60-second repeated vertical jumps

D. Agility ladder with fixed patterns

204. An athlete's VJ hasn't improved after 12 weeks of plyometrics. Squat is 1.1× body weight. The modification is which of the following?

A. Continue identical plyometric program

B. Complete cessation for 6 months

C. Eliminate all lower body training

D. Add heavy resistance training — squat below 1.5× 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. Only bench press

B. Only body composition

C. Aerobic capacity, sprint speed, agility, power, strength, and body composition

D. Only flexibility

ORGANIZATION AND ADMINISTRATION (Questions 207–220)

207. A facility for 50 athletes at NSCA minimum (40 sq ft/athlete) requires which floor space?

A. 2,000 sq ft minimum (upper guideline 60 sq ft = 3,000 sq ft)

B. 500 sq ft

C. 5,000 sq ft

D. 1,000 sq ft

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

A. Only when the 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

B. CPR and AED use

C. EMT-paramedic certification

D. Wilderness first responder

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

A. Maximum required insurance coverage

B. Minimum professional salary

C. The care a reasonably competent professional would exercise under similar circumstances

D. Required continuing education credits

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

A. Gross negligence or reckless conduct

B. Inherent risks disclosed and assumed

C. Normal training soreness

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 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. Continued use until failure

B. Hidden from athletes

C. Immediate removal, tagging, documentation, repair/replace before return

D. Wait for manufacturer visit

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

A. Decline unsafe practices and advocate for athlete safety

B. Always comply with the coach

C. Resign without discussion

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. Ignore the situation

B. Encourage higher loads

C. Address the concern with colleague/supervisor

D. Post on social media

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

A. Enforce the policy — proper footwear required before training

B. Allow training in sandals

C. Allow barefoot training

D. Modify policy for this athlete

220. The CSCS holds which authority regarding the program?

A. No authority — coach decides

B. Equipment purchasing only

C. Off-season authority only

D. Ultimate authority for program design, implementation, and supervision

PRACTICE EXAM 10 — ANSWER KEY WITH EXPLANATIONS

SECTION 1 — SCIENTIFIC FOUNDATIONS

EXERCISE SCIENCE (Questions 1–52)

1. B — Chronic resistance training and sprint work promote the well-documented conversion of Type IIx fibers to the more fatigue-resistant Type IIa phenotype within the Type II fiber spectrum. This is the most consistently observed fiber type transition in exercise science research. The Type IIa fibers retain their fast-twitch contractile characteristics while gaining improved oxidative capacity and resistance to fatigue.

2. D — The sarcoplasmic reticulum is the specialized organelle that stores calcium ions during the resting state and releases them into the sarcoplasm upon receiving signals transmitted by the T-tubules. When the action potential reaches the SR via the T-tubule system, voltage-sensitive receptors trigger the opening of calcium release channels. This calcium flood initiates the binding to troponin C that enables cross-bridge formation and muscle contraction.

3. C — A 38% strength increase with only 2% structural change in 6 weeks is the hallmark of neural adaptation — improved motor unit recruitment, enhanced rate coding, reduced antagonist co-contraction, and better intermuscular coordination. In novice trainees, the nervous system's ability to activate existing muscle tissue improves dramatically before measurable hypertrophy develops. This explains why early strength gains far outpace visible changes in muscle size.

4. A — At the optimal resting length, the overlap between actin and myosin filaments allows the maximum number of cross-bridges to form simultaneously, producing peak force output. At lengths shorter than optimum, actin filaments from opposite sides overlap and compress against the Z-lines, interfering with cross-bridge formation. At lengths longer than optimum, too few cross-bridges can form because the filaments are pulled apart.

5. D — According to the force-velocity relationship, higher loads at slower contraction velocities allow more cross-bridges to form simultaneously and complete the power stroke, producing greater maximal force. The 90% 1RM squat places the muscle at the high-force, low-velocity end of the curve. The 30% 1RM jump squat operates at the high-velocity, lower-force end where speed is prioritized over maximal force production.

6. C — Henneman's Size Principle establishes that motor units are recruited in an orderly sequence from smallest (lowest threshold, Type I) to largest (highest threshold, Type IIx) as force demands increase. The highest-threshold motor units innervating Type IIx fibers are activated only when

force demands reach approximately 80-85% or more of maximal voluntary contraction. This is why heavy loads are essential for recruiting the full motor unit pool and developing maximal strength.

7. A — Storage and return of elastic energy in the musculotendinous unit is one of the three recognized SSC mechanisms. During the rapid eccentric countermovement, the tendons and elastic components of the muscle-tendon complex stretch and store potential energy that is returned as mechanical work during the subsequent concentric phase. The other two mechanisms are the stretch reflex from muscle spindle activation and increased time for force development during the eccentric phase.

8. B — The exponential rise from 1.9 mmol/L at 200 watts to 5.1 mmol/L at 250 watts identifies the lactate threshold — the intensity where lactate production began exceeding the body's clearance capacity. Below 200 watts, production and clearance were balanced and lactate remained stable. Above this threshold, accumulation accelerates exponentially, indicating the transition to metabolically unsustainable conditions.

9. D — A 45-second all-out effort falls squarely within the glycolytic-dominant duration range (approximately 15 seconds to 2-3 minutes). Anaerobic glycolysis rapidly breaks down muscle glycogen, producing pyruvate that is converted to lactate with accompanying hydrogen ion accumulation. The rising H^+ concentration reduces intracellular pH, impairing cross-bridge cycling and enzymatic function — producing the severe burning, high blood lactate, and progressive power decline.

10. C — The progressive RER decrease from 0.86 to 0.76 over 4 hours reflects a gradual shift from carbohydrate toward greater fat oxidation as muscle 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. The lower RER (closer to 0.70) indicates a higher proportion of energy coming from fat metabolism.

11. A — Oxygen serves as the final electron acceptor at the end of the electron transport chain, combining with electrons and hydrogen ions to form water. Without oxygen to accept the electrons, the entire chain backs up — NADH and $FADH_2$ cannot be reoxidized, the Krebs cycle stalls, and aerobic ATP production ceases entirely. This absolute oxygen requirement is why aerobic metabolism cannot function under anaerobic conditions.

12. B — Despite yielding approximately 129 ATP per molecule of palmitate versus 36-38 from glucose, fat oxidation produces ATP at a rate far too slow to match the rapid energy demand of high-intensity exercise. The rate limitation — not total yield — determines which substrate dominates at any given intensity. Carbohydrate pathways (glycolysis and oxidative phosphorylation of pyruvate) produce ATP at a faster rate, making them essential when energy demand is high.

13. D — After 3.5 hours at 68% VO_2max, muscle and liver glycogen stores become substantially depleted and blood glucose drops to hypoglycemic levels (48 mg/dL). Without adequate carbohydrate substrate, the body cannot maintain the rate of ATP production needed to sustain the exercise intensity. This is the classic endurance "bonk" or "hitting the wall," which can only be prevented or delayed through strategic carbohydrate intake during the event.

14. C — After stroke volume plateaus at approximately 40-60% of VO_2max, further increases in cardiac output depend 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). This is why maximal heart rate is a key limiter of maximal cardiac output and therefore VO_2max.

15. A — For upward acceleration to occur during the squat ascent, the ground reaction force must exceed the combined weight of the athlete plus the barbell — the total system weight. Any GRF below this threshold merely decelerates the downward movement or supports the static load. Only the net force above the total system weight produces the positive upward acceleration needed to stand up from the bottom position.

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 of the conventional deadlift.

17. D — Hydrogen ions produced by glycolytic metabolism are buffered by the bicarbonate system: $H^+ + HCO_3^- \rightarrow H_2O + CO_2$. The additional 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. C — Peak muscular power (the product of force × 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 extremes of the curve — maximum force with near-zero velocity, or maximum velocity with near-zero force — the power output is low. This is why power training uses moderate loads moved at high velocities.

19. A — The 18-degree difference between passive ROM (176°) and active ROM (158°) 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 point where the individual's own muscles can actively produce or 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 × stroke volume = 47 bpm × 112 mL = 5,264 mL/min (approximately 5.3 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 compensates for the low resting heart rate (athletic bradycardia). The heart pumps the same total volume per minute with fewer, more powerful beats.

21. D — Blood flow redistribution during maximal exercise is achieved through two complementary mechanisms working simultaneously: local metabolic vasodilation in working muscles (mediated by increased CO_2, decreased O_2, elevated 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 but provides superior neural adaptation.

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 account for a larger proportion of total strength gains in females because the lower testosterone environment (10-15× less than males) limits the magnitude of structural hypertrophy. Neural adaptation pathways are not testosterone-dependent.

24. B — A progressively declining testosterone-to-cortisol 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. This requires significant reduction in training volume and intensity, a structured recovery phase, and referral for medical evaluation.

25. D — According to Wolff's Law, 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, far exceeding non-weight-bearing alternatives like swimming or cycling.

26. C — With identical 1RM values (190 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 (approximately 200-400 ms), Athlete A produces force more rapidly, generating a

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 the stationary start. Running upright during acceleration would direct forces too vertically, reducing the horizontal component essential for forward propulsion.

28. B — Research on elite sprinters consistently demonstrates that the vertical ground reaction force applied during the brief ground contact phase (80-100 milliseconds) 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. D — Chronic heavy resistance training reduces the Golgi tendon organ's inhibitory influence on the alpha motor neurons innervating the trained muscle. This neural disinhibition allows trained athletes to voluntarily activate a greater percentage of their motor unit pool and produce force closer to the true structural capacity of their musculotendinous units. This is a significant neural contributor to strength gains beyond what structural hypertrophy alone can explain.

30. C — The 12 cm difference between the CMJ (66 cm) and the SJ (54 cm) represents the contribution of the stretch-shortening cycle to concentric force production. The rapid countermovement stores elastic energy in the musculotendinous unit that is returned as mechanical work, activates the stretch reflex through muscle spindle stimulation, and provides additional time for force development as tension builds during the eccentric phase before the concentric begins.

31. A — 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 at the distal end — a small amount of muscle shortening produces a large, fast movement at the hand or foot. The tradeoff is that the muscle must produce force many times greater than the external load.

32. D — The principle of accommodation states that the response to a constant, unchanging stimulus diminishes over time as the body fully adapts to that specific stress. After 22 weeks of identical programming, introducing variation in exercises, loads, volumes, or the periodization model provides novel stimuli that the body has not yet adapted to. This variation overcomes the plateau and restarts the adaptive process.

33. B — Tendons and ligaments have lower metabolic activity and blood supply compared to muscle tissue, resulting in slower rates of collagen synthesis and structural remodeling. This means that connective tissues require more time to adapt to increased training loads than the muscles they

support. Rapid muscular strength gains can outpace connective tissue strengthening, creating a window of increased injury risk that requires gradual progressive overload.

34. C — Slow jogging develops oxidative capacity and slow-twitch fiber efficiency but fails to develop the explosive jumping power, lateral agility, overhead hitting/serving power, and anaerobic sprint recovery capacity that volleyball demands. The SAID principle requires that the training stimulus specifically match the sport's physical demands. Adaptations from steady-state aerobic training do not transfer to the explosive, multidirectional, and anaerobic demands of competitive volleyball.

35. A — Eccentric force production increases with lengthening velocity up to a plateau approximately 20-60% above maximal isometric force. This means athletes can safely control and lower loads that exceed their concentric 1RM. This characteristic forms the basis for supramaximal eccentric training — loading the eccentric phase beyond the concentric maximum to provide a novel overload stimulus for strength and connective tissue adaptation that concentric-only training cannot provide.

36. D — Aerobic capacity (VO_2max) declines most rapidly during detraining, with measurable reductions occurring within 1-2 weeks of inactivity and significant losses accumulating by 4-8 weeks. Maximal strength is more resistant to detraining, typically maintaining for 2-4 weeks or longer after cessation. This hierarchy of detraining rates is critical for prioritizing which qualities to maintain during injury rehabilitation or in-season competition periods.

37. B — Torque = force × moment arm = (7 kg × 9.81 m/s²) × 0.58 m = 68.67 N × 0.58 m ≈ 39.8 N·m. The mass must first be converted to force in Newtons by multiplying by gravitational acceleration (9.81 m/s²), then multiplied by the perpendicular distance from the joint axis to the line of gravitational force. This calculation demonstrates why even light dumbbells create substantial torque demands on the shoulder during lateral raises.

38. 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. This prevents diastolic pressure from rising despite the increased blood flow, keeping it stable or slightly decreased.

39. A — The combination of 8-month amenorrhea, grossly inadequate caloric intake (1,200 kcal with 2.5 hours daily training), and DEXA-confirmed decreased lumbar bone mineral density 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, which in turn impairs calcium metabolism and bone remodeling leading to decreased BMD and stress fracture risk.

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 provide glucose for the brain —

which is obligatorily glucose-dependent — and other glucose-requiring tissues during periods of metabolic stress when glycogen stores are being depleted.

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 (8+ hours), and subjective recovery between sessions, this hormonal profile confirms successful adaptation to the training program. This is the opposite of the declining T:C ratio seen in overtraining syndrome.

42. C — Enhanced androgen receptor density increases the muscle's sensitivity and responsiveness to circulating testosterone at the tissue level. This means each testosterone molecule produces a stronger anabolic signal, potentially amplifying the hypertrophic and strength response to training even without any changes in basal circulating hormone concentrations. This is a significant adaptation that improves the muscle's ability to utilize the hormonal environment for growth.

43. A — The progressive RER increase from 0.76 (predominantly fat oxidation) to 0.99 (predominantly carbohydrate oxidation) describes the crossover concept — the intensity-dependent shift from fat to carbohydrate dominance as exercise intensity increases. As the body requires faster rates of ATP production at higher intensities, it progressively relies more on carbohydrate pathways that can produce ATP at a faster rate than fat oxidation.

44. D — The Cori cycle recycles lactate produced by working muscles into usable glucose through hepatic gluconeogenesis, then releases that glucose back into the blood for use by the muscles and brain. This pathway is particularly critical because the brain is obligatorily glucose-dependent and cannot use fat directly as fuel. During sustained exercise as glycogen depletes, the Cori cycle helps maintain blood glucose levels to support continued function of both the brain and working muscles.

45. B — The creatine kinase reaction (PCr + ADP → ATP + Cr) is a simple, single-step enzymatic process occurring directly in the sarcoplasm without requiring oxygen, mitochondria, or complex multi-step metabolic pathways. This simplicity makes it the fastest ATP-regenerating system in the body, capable of producing ATP almost instantaneously. This rate advantage makes the phosphagen system dominant during the first 6-10 seconds of maximal-effort activity.

46. 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 a resistance greater than in a third-class lever arrangement. This is why the calf muscles can support and lift the entire body weight during plantar flexion.

47. A — The stretch reflex (myotatic reflex) is activated when muscle spindles detect the rapid eccentric stretch upon plyometric landing. This monosynaptic reflex arc — involving only a single synapse between the afferent sensory neuron and the efferent alpha motor neuron — produces the fastest possible reflexive contraction. During plyometric training, this reflex augments the

concentric force production during the takeoff, contributing to the stretch-shortening cycle enhancement.

48. D — The "muscle memory" phenomenon is explained by retained myonuclei from prior hypertrophic training. During initial hypertrophy, satellite cells fuse with existing muscle fibers and donate additional nuclei. These myonuclei persist even during detraining-induced atrophy, creating a lasting structural change. 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.

49. B — When the amortization phase exceeds approximately 250 milliseconds, 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 that maximally stimulates the spindle has been disrupted by the prolonged delay.

50. C — Both athletes produce identical peak force (2,900 N), but Athlete A reaches peak force in 140 ms versus 270 ms for Athlete B — demonstrating superior rate of force development. During the limited ground contact time of a vertical jump, faster RFD produces a greater impulse (area under the force-time curve), which results in higher takeoff velocity and therefore greater jump height. RFD is the critical discriminator when peak force is equal between athletes.

51. A — The Golgi tendon organ detects elevated tension during the 6-second isometric contraction of the contract-relax PNF technique. The GTO sends inhibitory signals through an Ib inhibitory interneuron to the alpha motor neurons innervating the target muscle. This autogenic inhibition temporarily reduces the muscle's tone and resistance to passive stretch, allowing a greater range of motion immediately following the contraction than was achievable before it.

52. D — The law of diminishing returns explains that the novice captures rapid neural adaptations (45% strength gain with minimal hypertrophy) because their nervous system has abundant untapped potential. The experienced lifter has already maximized most neural adaptations and must rely on the slower process of structural hypertrophy for smaller incremental gains (3% strength with measurable hypertrophy). This neural-to-structural shift characterizes the progression from novice to intermediate and advanced training status.

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 of failure. Cognitive anxiety requires cognitive interventions such as thought stopping and positive self-talk replacement, rather than physical relaxation techniques which target somatic symptoms. Distinguishing between cognitive and somatic anxiety components is essential for selecting the appropriate intervention strategy.

54. D — According to the inverted-U hypothesis, a maximal deadlift is a gross motor, high-force task that benefits from relatively high arousal levels. Elevated physiological activation supports maximal muscle recruitment, aggressive force production, and the intense focused effort required for near-maximal lifting. Fine motor precision tasks like archery require lower optimal arousal because excessive activation causes tremor and attentional narrowing.

55. A — 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 motivation and accountability at every level from the training session to the championship competition.

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 performance contexts.

57. D — 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 like body type and training experience.

58. C — "Your elbow dropped during that clean catch" describes the quality of the movement pattern — how the technique was executed rather than the outcome of the lift. This is knowledge of performance (KP), which provides actionable information the athlete can use to correct their technique on subsequent repetitions. Knowledge of results (KR) would describe the outcome, such as "That was a failed lift" or "You cleaned 100 kg."

59. A — The contextual interference effect demonstrates that random practice (intermixing multiple exercises throughout a session) produces slower initial performance compared to blocked practice 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 feedback after every single 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 athletes to attend to their own sensory information, building self-monitoring skills that produce more self-sustaining, lasting motor learning.

61. B — 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 weightlifter can focus on bar speed and session strategy rather than body positions during each repetition.

62. C — 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 time between trials for this consolidation, resulting in less robust long-term encoding.

63. A — Consistent practice excellence with systematic competitive underperformance, combined with intense worry, fear of failure, and disruptive negative self-talk, indicates choking under pressure. Excessive cognitive anxiety in high-stakes situations disrupts the automatic motor execution that the athlete demonstrates in the low-pressure practice environment. The well-learned skill reverts to conscious, effortful processing that degrades the quality and fluency of execution.

64. D — Athletic burnout is characterized by three interrelated dimensions: emotional exhaustion (feeling physically and psychologically drained), depersonalization (cynicism and detachment from the sport), and reduced sense of personal accomplishment (feeling that effort is no longer producing meaningful results). Burnout develops over weeks to months and requires professional intervention, distinguishing it from acute anxiety or normal mood fluctuation.

65. B — Increasing isolation, persistent feelings of worthlessness, loss of interest in previously enjoyed activities, and expressed hopelessness about the future are potential warning signs of clinical depression in an adolescent. The strength and conditioning specialist must recognize these signs and recommend that parents seek evaluation from a qualified mental health professional. Attempting to address these symptoms through training modifications or increased competition is inappropriate and potentially harmful.

66. C — Extreme weight manipulation, avoidance of team meals, excessive exercise beyond the training plan, and preoccupation with body weight are recognized warning signs of disordered eating that require professional evaluation. Diagnosing and treating eating disorders is outside the CSCS scope of practice. The specialist must refer the athlete to a qualified healthcare professional — attempting to manage the condition through meal planning or body composition monitoring is inappropriate.

67. A — Self-determination theory identifies autonomy (sense of choice and control), competence (feelings of mastery and effectiveness), and relatedness (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 form of motivation — intrinsic drive that persists without external rewards or punishments.

68. D — RED-S in male athletes produces suppressed testosterone (from disrupted hypothalamic-pituitary-gonadal axis), decreased bone mineral density (from impaired hormonal signaling and calcium metabolism), impaired immune function (from insufficient energy for immune processes), and declining athletic performance (from cumulative energy deficit). The condition is driven by chronic low energy availability regardless of sex, expanding beyond the original female athlete triad.

69. B — Fear of re-injury after ACL reconstruction is a recognized psychological barrier to successful return to sport that requires a comprehensive approach. Gradually reintroducing sport-specific movements at progressive intensities builds physical confidence through direct mastery experiences, while referral to a sport psychologist addresses the cognitive and emotional components through evidence-based psychological interventions such as graded exposure and cognitive restructuring.

70. C — Research consistently demonstrates that athletes experiencing significant psychological distress during rehabilitation — including fear of re-injury, frustration, depression, and social isolation from the team — have longer recovery timelines and higher re-injury rates compared to psychologically well-adjusted athletes. This evidence underscores the importance of addressing psychological factors as an integral component of comprehensive injury management and return-to-play protocols.

71. A — Past performance accomplishment is the most powerful of Bandura's four self-efficacy sources. Successfully completing the 185 kg squat provides direct, personal evidence of capability at this load level, creating the strongest possible confidence that 190 kg is achievable. Mastery experiences generate stronger and more resilient efficacy beliefs than vicarious observation, verbal encouragement, or physiological state interpretation.

72. D — Scanning the entire court to identify open teammates requires broad-external attentional focus — perceiving multiple external stimuli across a wide visual field simultaneously. This allows the point guard to process multiple defenders, teammates, spacing, and movement patterns before narrowing focus to a specific passing target as the play develops. Effective athletes fluidly shift between attentional modes based on changing situational demands.

73. B — When a pitcher throws a fastball and then a changeup, the overall speed and absolute force of the execution change (variable parameters), while the invariant features — relative timing of muscle activations, relative force proportions between muscle groups, and the fundamental spatial pattern of the throwing motion — remain constant. This variable parameter adjustment is the functional advantage of generalized motor programs, allowing the same base movement to be adapted to different situations.

74. C — Muscle tension, elevated heart rate, and rapid shallow breathing are somatic anxiety symptoms — the physiological 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. Cognitive interventions target thoughts, not physical symptoms.

75. A — The front squat develops the upright torso position, high-elbow rack posture, and deep receiving stance that directly transfer to the power clean catch. Shared movement features between exercises create positive transfer — practice on the front squat directly improves the quality and confidence of the power clean receiving position. This is a deliberate exercise selection strategy based on movement pattern similarity and common postural demands.

NUTRITION (Questions 76–95)

76. D — A 100 kg athlete at 2.2 g/kg/day requires 220 grams of protein daily (100 × 2.2 = 220). 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 (80 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 is why leucine content is a key consideration when evaluating protein source quality for athletic recovery.

78. C — Chronically inadequate dietary fat intake (below 15-20% of total calories) impairs steroid hormone production because cholesterol — a lipid molecule obtained from dietary fat — 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 — directly compromise health, recovery, and training adaptation.

79. A — Exercise-associated hyponatremia occurs when excessive plain water intake during prolonged exercise dilutes blood sodium concentration below safe levels (below 135 mmol/L). 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 the loading phase) 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 — it simply takes 4 weeks instead of 1 week to get there through gradual daily accumulation.

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; by blocking these receptors, caffeine reduces the perception of fatigue, 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. C — 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 hydrogen ion accumulation is the primary performance limiter. Activities shorter than this are phosphagen-dependent, and activities longer than this are primarily aerobic — neither duration benefits substantially from enhanced intracellular buffering.

83. A — NSF Certified for Sport and Informed Sport are third-party certification programs that independently test supplement products 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. No other certification provides equivalent assurance of banned substance screening.

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 (providing the mechanical stimulus to retain muscle), this protein intake represents the strongest evidence-based defense against lean mass loss during weight loss.

85. B — Gastrointestinal distress — including nausea, bloating, abdominal cramping, and diarrhea — is the most common side effect that limits the practical use of sodium bicarbonate as an ergogenic aid. 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. C — A 75 kg athlete at 10 g/kg/day requires 750 grams of carbohydrate daily ($75 \times 10 = 750$). 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 and snacks distributed throughout the day.

87. A — Documented consequences of vitamin D deficiency in athletes include impaired muscle function (reduced strength and power output), compromised immune competence (increased susceptibility to illness), and elevated risk of stress fractures with decreased bone mineral density. Athletes who train primarily indoors, live at northern latitudes with limited UV exposure, or have darker skin pigmentation are at the greatest risk for insufficiency.

88. D — Vitamin C enhances non-heme iron absorption by converting ferric iron (Fe^{3+}) to the more bioavailable ferrous form (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. Consuming vitamin C-rich foods alongside non-heme iron sources at the same meal maximizes absorption.

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, which catalyzes glycogen storage in the muscle, is most active immediately post-exercise and decreases over the following hours. Early carbohydrate intake maximizes the rate of glycogen resynthesis before the second session.

90. C — 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 tend to be low in lysine but adequate in methionine, while legumes have the opposite profile. Combining multiple plant sources across meals provides all essential amino acids in adequate quantities without requiring animal products.

91. A — 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 and recovery.

92. D — High-glycemic index foods produce rapid blood glucose and insulin responses after ingestion, 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 into muscle cells during the critical recovery window.

93. B — Glutamine supplementation 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 currently classified among the supplements with strong ergogenic evidence for hypertrophy or performance enhancement. The supplements with robust evidence include creatine monohydrate, caffeine, beta-alanine, and sodium bicarbonate.

94. C — Dietary fat serves multiple essential physiological functions: steroid hormone production (testosterone and other hormones require cholesterol as a precursor), absorption of fat-soluble vitamins (A, D, E, and K require dietary fat for intestinal transport), cell membrane integrity (phospholipid bilayers depend on fatty acid composition), and provision of essential fatty acids (linoleic and alpha-linolenic acid) that the body cannot synthesize and must obtain from the diet.

95. A — The general fluid intake guideline of approximately 200-300 mL every 15-20 minutes during competition helps prevent body weight loss from exceeding 2%, the threshold at which measurable performance impairments begin. Individual sweat rates vary significantly (0.5-2.5 L/hour depending on intensity, body size, and environmental conditions), so the guideline should be personalized based on pre- and post-exercise body weight measurements during training to determine individual fluid needs.

SECTION 2 — PRACTICAL/APPLIED

EXERCISE TECHNIQUE (Questions 96–140)

96. D — Before loading any barbell exercise, each novice athlete should demonstrate an unloaded bodyweight squat to assess fundamental movement competency. This screening evaluates ankle dorsiflexion, hip flexion, thoracic extension, knee tracking alignment, and spinal neutrality — identifying mobility restrictions and motor control deficiencies that must be corrected before external load is safely added. Loading a dysfunctional movement pattern reinforces compensation and increases injury risk.

97. B — Heels rising during the squat descent indicates insufficient ankle dorsiflexion mobility — the tibia cannot translate forward enough over the foot to maintain the center of mass over the base of support with the heels down. The body compensates by shifting weight forward onto the toes. Addressing this through ankle mobility work, elevated heel shoes, or targeted stretching allows proper squat mechanics with full foot contact.

98. C — When the barbell drifts forward of the shins during the deadlift, the horizontal distance between the bar and the lumbar spine increases dramatically. Because torque equals force multiplied by moment arm, this increased distance amplifies the flexion torque that the erector spinae must resist to maintain spinal neutrality. The result is substantially increased lumbar injury risk and a mechanically disadvantaged pulling position.

99. A — An open (false) grip positions the thumbs on the same side as the fingers, allowing the barbell to roll out of the hands onto the chest, neck, or face — a potentially catastrophic and life-threatening event. A closed grip with thumbs fully wrapped around the bar creates a mechanical lock that prevents this uncontrolled bar displacement. This is a non-negotiable safety requirement for all bench press training.

100. D — Excessive lumbar hyperextension under load during the overhead press creates dangerous compressive and shear forces on the lumbar vertebrae, intervertebral discs, and facet joints. This compensation simultaneously shifts the exercise toward an incline press pattern and reduces the effective overhead range of motion. The arch indicates the load exceeds the athlete's strict pressing capacity and should be reduced.

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. Teaching the catch before the pull prevents dangerous receiving errors.

102. C — Premature elbow bending during the second pull substitutes arm strength (biceps, brachialis) for the far more powerful hip extensors (gluteus maximus, hamstrings) that should drive the bar upward through explosive triple extension. The arms should remain straight during the second

pull, acting as passive connectors that transmit the force generated by the lower body to the barbell. Pulling with the arms limits bar velocity and the maximum weight that can be cleaned.

103. A — Novice athletes entering plyometric training for the first time 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 that are only developed through progressive plyometric experience over multiple training cycles.

104. D — A single spotter for the barbell back squat positions directly behind the athlete with arms extending under the armpits, ready to assist the athlete upward at the torso if the lift fails. The spotter should never grip the barbell directly because this creates asymmetric loading that can cause dangerous bar tilting. Assisting at the torso supports the athlete's body while allowing them to control the barbell position.

105. B — The Valsalva maneuver is appropriate specifically for healthy, trained athletes performing heavy compound lifts (near-maximal squats, deadlifts, overhead presses) where the extreme intra-abdominal pressure provides essential spinal stabilization. It is contraindicated for individuals with uncontrolled hypertension or cardiovascular disease because the extreme blood pressure spikes (potentially exceeding 400/300 mmHg) may exceed the structural limits of compromised blood vessels.

106. C — 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 to a manageable weight, and the athlete cued to maintain a rigid neutral spine with the pulling motion initiated by deliberate scapular retraction before the elbows bend. Momentum-based rowing bypasses the target muscles and risks spinal injury.

107. A — A baseball pitcher needs both rotational power for the throwing motion and anti-rotation stability for deceleration and spinal protection during the follow-through. Medicine ball rotational throws develop the explosive power component through the stretch-shortening cycle, while Pallof press variations develop the anti-rotation stability that protects the spine from the massive rotational forces generated during high-velocity throwing.

108. D — Anti-extension exercises train the core musculature to resist lumbar hyperextension — the tendency for the lumbar spine to arch as gravity or external load pulls it into an extended position. During the ab wheel rollout, the rectus abdominis and deep trunk stabilizers must contract to maintain spinal neutrality against this extending force as the body elongates. This anti-extension function is directly relevant to maintaining spinal stability during loaded athletic movements.

109. B — Running fully upright during the acceleration phase (first 10-30 meters) directs ground reaction forces too vertically, reducing the horizontal force component needed to overcome the body's inertia and generate forward momentum from a stationary or near-stationary start. The pronounced forward lean during acceleration allows the athlete to push more horizontally

backward against the ground, producing the forward-directed reaction force essential for rapid horizontal acceleration.

110. C — The pro agility shuttle uses a completely preplanned movement pattern — the athlete knows exactly where to go and when to change direction before the test begins. True agility requires a reactive perceptual-cognitive decision-making component where the athlete must perceive, process, and respond to an unpredictable stimulus while simultaneously executing a direction change. This decision-making element is what distinguishes agility from change-of-direction speed.

111. A — Dynamic stretching increases range of motion while simultaneously activating the neuromuscular system through active muscle engagement and progressive movement intensity. Static stretching before explosive exercise has been shown to acutely reduce force production, power output, and sprint performance by decreasing musculotendinous stiffness and reducing neural activation. This evidence base is why dynamic stretching has largely replaced static stretching as the preferred pre-exercise flexibility method.

112. D — Foam rolling provides range of motion improvements comparable to static stretching but without the acute decrements in force production, power output, and reactive strength that accompany sustained static stretches. This makes foam rolling a preferred pre-training mobility tool because it enhances flexibility while preserving the muscular stiffness and neural activation needed for subsequent explosive performance.

113. B — The correct warmup sequence progresses from general to specific: general warmup (5-10 minutes of low-intensity whole-body activity raising tissue temperature) → dynamic stretching (active movement patterns specific to the upcoming session) → movement preparation (activation drills, low-intensity plyometrics) → specific warmup (progressive loading in the session's primary exercises building toward working weight). This systematic progression optimizes readiness.

114. C — Chronic cold water immersion after every resistance training session may blunt the inflammatory signaling cascades (prostaglandins, cytokines, satellite cell activation) that are necessary for muscle protein synthesis, tissue remodeling, and the structural adaptations that drive hypertrophy and strength gains. The acute inflammation following training is a functional part of the adaptive cascade — chronically suppressing it with CWI may impair long-term gains.

115. A — Adequate sleep (7-10 hours nightly) and appropriate post-exercise nutrition (protein for muscle repair and carbohydrate for glycogen replenishment) are the foundational recovery practices with the strongest evidence base. During sleep, growth hormone secretion peaks, protein synthesis is elevated, and neural recovery occurs. No external recovery modality — compression boots, cryotherapy, electrical stimulation — can compensate for deficits in these non-negotiable biological requirements.

116. D — Basketball's 48-minute games with diverse physical demands require a comprehensive conditioning approach: aerobic base training (tempo runs, fartlek) for sustained play across four

quarters, anaerobic interval training (court-length sprints with sport-specific rest periods) for repeated sprint ability, and reactive agility conditioning (direction changes in response to unpredictable defensive and offensive game situations).

117. B — The aerobic system's most important contribution to team sport athletes is recovery capacity between high-intensity efforts. Between sprints and explosive plays, the aerobic system replenishes phosphocreatine stores, clears lactate and hydrogen ions, and restores metabolic homeostasis. Athletes with superior aerobic fitness recover faster between efforts, maintaining higher performance quality across repeated bouts throughout the entire competition.

118. C — A football defensive back performing 4-6 second sprint routes with 25-40 seconds of huddle rest operates at approximately a 1:5 to 1:8 work-to-rest ratio, targeting the phosphagen system with near-complete phosphocreatine recovery between efforts. This ratio matches the sport-specific energy demand pattern and ensures maximal-quality sprint repetitions that accurately replicate the position's competitive demands.

119. A — Tempo running at lactate threshold intensity (75-85% of maximum heart rate) for 20-30 minutes trains the body to sustain higher absolute running speeds before lactate production exceeds clearance capacity. This adaptation effectively raises the lactate threshold to a higher percentage of VO_2max, meaning the athlete can work at a greater absolute intensity aerobically before the onset of fatigue-inducing metabolic accumulation.

120. D — Active recovery at low intensity promotes blood flow to recovering tissues, facilitating delivery of nutrients and oxygen while assisting removal of metabolic waste products including lactate, hydrogen ions, and heat. This enhanced circulatory benefit is the primary proposed mechanism by which active recovery may improve subjective recovery perceptions compared to complete passive rest on the day following intense training.

121. B — When elbows drop during the front squat, the bar loses its stable shelf on the anterior deltoids and rolls forward, creating dangerous loss of control. The forward bar shift increases the flexion torque on the spine and places excessive stress on the wrists and elbows as they attempt to hold the falling bar. High elbows with upper arms parallel to the floor are essential for maintaining the secure front rack position.

122. C — The reverse lunge reduces shear force on the front knee 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 forces transmitted through the patellofemoral joint and quadriceps tendon that contribute to knee pain.

123. A — Moving the front foot further from the bench during the Bulgarian split squat creates a more vertical shin angle, reducing the magnitude of forward knee translation. This technique modification shifts the primary loading emphasis from the knee extensors (which are stressed by

forward knee travel) to the hip extensors (glutes and hamstrings), decreasing the shear forces on the anterior knee structures responsible for the reported strain.

124. D — The hex bar positions the load at the athlete's sides rather than in front of the body, centering the 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, making the hex bar a lower-risk alternative for many athletes.

125. B — When spotting dumbbell pressing exercises, the spotter should apply assistance at the wrists near the athlete's hands. Spotting at the elbows creates a dangerous fulcrum effect that could cause the athlete to lose control, and the dumbbells themselves may move independently if gripped directly. Wrist contact allows the spotter to guide the load effectively in the intended direction while the athlete maintains control of each dumbbell.

126. C — Resistance bands provide minimum resistance at the bottom of the squat (where the band is least stretched) and maximum resistance at the top (where the band is fully stretched). This accommodating resistance 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 full range of motion.

127. A — For a medicine ball rotational throw to qualify as a plyometric exercise, it must be performed with maximal speed and minimal transition time between the eccentric catch phase and the concentric throwing phase. This rapid stretch-shortening cycle execution stores and returns elastic energy and activates the stretch reflex — the mechanisms that define plyometric training. A paused, slow, or heavy throw eliminates these mechanisms.

128. D — 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. This safety clearance is the primary consideration for platform placement within any facility layout.

129. B — Organizing athletes into groups of 3 per squat rack creates an efficient rotation where 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.

130. C — 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 momentary balance loss, causing sudden weight redistribution that may result in loss of control, dropped weights, or direct injury to the athlete or bystanders. Collars are a non-negotiable safety requirement.

131. A — Power cleans are the power/explosive exercise in the program 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 in the session when the athlete is freshest. The remaining exercises follow in descending order of technical demand: core multi-joint → assistance → core stability.

132. D — A single bench press spotter uses an alternated grip (one hand pronated, one supinated) close to the center of the bar. The alternated grip provides superior grip security compared to a double overhand grip by preventing the bar from rolling in either direction. The central positioning allows symmetric upward force application to assist the athlete without interfering with pressing mechanics.

133. B — An athlete who demonstrates explosive performance on the field but struggles with heavy barbell exercises has a maximal strength deficit — their explosive ability and power expression outpace their force production capacity. Heavy resistance training at 85% or more of 1RM develops the larger force foundation upon which explosive movements draw, allowing even greater power output when strength is combined with the existing explosiveness.

134. C — Correct Romanian deadlift technique includes a slight, constant knee flexion maintained throughout the movement, a flat neutral spine, a hip hinge pattern (not a squat), and the barbell tracking close to the legs during both the descent and ascent. The RDL targets the hamstrings and glutes through controlled eccentric hip flexion with the primary movement occurring at the hip joint rather than the knees.

135. A — Pull-ups and lat pulldowns develop the upper body pulling strength essential for generating propulsive force during the swim stroke. Internal and external rotation exercises protect the rotator cuff from the repetitive overuse injury common in swimmers. Core anti-rotation work develops the trunk stability needed for efficient force transfer between the upper and lower body during swimming.

136. D — 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 a neutral trunk alignment. This anti-rotation function develops the spinal stability needed to protect the lumbar spine during athletic movements involving rotational forces such as throwing, striking, and change of direction.

137. B — The snatch requires receiving the barbell overhead with fully locked arms while in a deep squat position with an upright torso. Overhead squat mobility assessment verifies that the athlete can maintain a stable, locked-arm overhead position with the bar while squatting to full depth. Without this prerequisite mobility, attempting the full snatch creates significant shoulder, wrist, and spinal injury risk.

138. C — A properly executed push-up maintains a rigid straight line from head to heels with the core braced throughout, the chest touches or nearly touches the floor at the bottom for full range of motion, and the elbows track at approximately 45 degrees from the torso. This elbow position

maximizes the training stimulus to the pressing muscles while protecting the shoulder from the impingement that occurs at extreme (90-degree) elbow flare angles.

139. A — Sprint intervals of 5-10 yards with 25-40 seconds of rest precisely replicate the offensive lineman's competitive demands — short maximal-effort plays (4-7 seconds) followed by brief huddle recovery periods (25-40 seconds). This protocol targets the phosphagen system at the position's actual work-to-rest ratio, ensuring that the conditioning adaptations transfer directly to the repeated short-burst pattern of game play.

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

PROGRAM DESIGN (Questions 141–184)

141. B — The 800-meter race (approximately 1:50-2:10 at near-maximal intensity) relies primarily on the glycolytic system for sustained high-intensity ATP production throughout the middle portions of the race, with the aerobic system contributing increasingly during the second half as glycolytic fatigue accumulates. The phosphagen system powers the explosive start and provides the final kick. All three systems contribute at different race phases.

142. C — A push jerk meets all criteria for power exercise classification: it is structural (loading the spine directly with the bar on the shoulders), performed explosively (rapid dip-and-drive followed by dropping under the bar into a receiving position), and involves multiple large muscle groups (quadriceps, glutes, deltoids, triceps, core) in a coordinated explosive movement pattern.

143. A — The hang clean is the power/explosive exercise in this session requiring the highest neuromuscular coordination, rate of force development, and technical precision. These qualities degrade rapidly with accumulated fatigue, making it essential to perform the hang clean first when the athlete is freshest. Subsequent exercises follow the standard hierarchy: core multi-joint → assistance → core stability.

144. D — Novice athletes with 3 months of experience benefit most from 2-3 total-body sessions per week using moderate loads (60-70% of 1RM), higher repetitions (10-15 per set), and emphasis on learning proper technique for fundamental movement patterns. This frequency provides adequate training stimulus while allowing sufficient recovery for the rapid neural and structural adaptations that characterize early training responses.

145. B — Loads greater than 85% of 1RM for 6 or fewer repetitions with 2-5 minutes of rest between sets target maximal strength development through neural adaptations. The heavy loading forces recruitment of the highest-threshold motor units (including Type IIa and IIx fibers), improves rate coding (firing frequency), and enhances intermuscular coordination. The extended rest allows

complete phosphocreatine recovery and neural restoration for maximal force production on every set.

146. C — 85% of 170 kg = 144.5 kg, rounded to approximately 144-145 kg per working set. Five sets of 4 repetitions at this load with 3-minute rest represents a heavy strength protocol targeting neural adaptation through near-maximal motor unit recruitment and rate coding improvement. This intensity and volume combination falls within the established parameters for maximal strength development.

147. A — Rest periods of 30-90 seconds are specifically prescribed for hypertrophy training because they maintain elevated metabolic stress — accumulated blood lactate, hydrogen ion concentration, and reduced intracellular pH — along with the acute hormonal environment (growth hormone, testosterone elevation) that supports the hypertrophic growth stimulus. Incomplete recovery sustains the metabolic conditions that contribute to the signaling cascade driving muscle growth.

148. D — DUP's primary advantage over linear periodization is more frequent exposure to different training stimuli within each week — for example, hypertrophy on Monday, strength on Wednesday, and power on Friday. This frequent variation prevents accommodation to any single training zone and allows simultaneous development of multiple physical qualities within the same training week, rather than addressing them sequentially across multi-week phases.

149. B — 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 (hypertrophy/endurance) through moderate-volume, high-intensity phases (strength) to low-volume, very-high-intensity phases (power/peaking). Each phase builds upon the adaptations of the preceding one.

150. C — Block periodization sequences three concentrated training blocks: accumulation (high volume at moderate intensity developing work capacity and structural foundation), transmutation (higher intensity converting structural gains into sport-specific strength and power), and realization (low volume at very high intensity for peaking performance at the target competition). Each block builds on the adaptations of the preceding block.

151. A — Maintaining training intensity at preparatory-period levels (80-85%+ 1RM) while reducing volume and frequency preserves the neural and muscular stimulus needed to maintain strength and power during the competitive season. Research consistently demonstrates that intensity is the single most critical variable for preventing in-season detraining — volume and frequency can be substantially reduced without significant strength loss as long as intensity is preserved.

152. D — The transition period following the competitive season should last approximately 2-4 weeks and focus on unstructured, low-intensity active recovery providing physical restoration from accumulated competition fatigue, psychological renewal of motivation and enthusiasm, opportunity to address minor nagging injuries, and mental preparation for the next training cycle.

153. B — Peak power output in the jump squat occurs at approximately 0-30% of back squat 1RM because the lighter loading allows the high contraction velocities needed to maximize the velocity component of the power equation (Power = Force × Velocity). Heavier loads increase force production but reduce velocity below the threshold where peak power is achieved, resulting in lower overall power output.

154. C — The hang clean achieves peak power output at approximately 70-80% of 1RM because it is a ballistic exercise where the load is accelerated throughout the entire range of motion. Sufficient mass is needed to generate meaningful force production while the explosive nature of the movement maintains velocity high enough for peak power expression. Very light loads lack sufficient mass for peak power despite high velocity.

155. A — Beginner athletes should start plyometric training with 80-100 foot contacts per session distributed across exercises of varying intensity (squat jumps, countermovement jumps, box jumps stepping down). This modest volume provides sufficient initial neuromuscular stimulus while limiting the eccentric loading on musculotendinous structures that have not yet been conditioned for the high-impact demands of plyometric training.

156. D — Plyometric sessions should be performed at the beginning of the training session after a thorough warmup, when the athlete is fresh for maximal effort and proper technique on every repetition. Plyometric training is quality-based — fatigue from prior heavy resistance training or conditioning degrades explosive output, impairs landing mechanics, increases ground contact times, and raises injury risk.

157. B — A squat at the 90th percentile with a vertical jump at the 28th percentile indicates a rate of force development deficit — the athlete has adequate maximal strength but cannot express it rapidly enough during the brief ground contact time of a jump. Programming should prioritize explosive training modalities (plyometrics, Olympic lifts, jump squats) that develop the neuromuscular system's ability to produce force quickly.

158. C — Soccer matches lasting 90 minutes with mixed aerobic and anaerobic demands require a comprehensive conditioning approach: aerobic base training (tempo runs, fartlek) for sustained play across two halves, anaerobic interval training (repeated sprints with sport-specific rest) for repeated sprint ability, and reactive agility conditioning (direction changes responding to unpredictable opponent movements and ball trajectories).

159. A — The transition period provides 2-4 weeks of physical and psychological recovery following the competitive season. Training is unstructured and low-intensity, allowing restoration from accumulated competition fatigue, treatment of minor injuries that developed during the season, and renewal of motivation and enthusiasm before the next annual training cycle begins.

160. D — Return-to-play protocols require objective performance criteria: bilateral strength and functional symmetry within 10% on relevant tests (hop, strength, balance), demonstrated competency in sport-specific movements (cutting, pivoting, sprinting), and formal medical

clearance from the treating physician or surgeon. Subjective reports of feeling "ready" are insufficient because persistent asymmetries exceeding 10% are associated with elevated re-injury risk.

161. B — Ice hockey shifts of 45-60 seconds with 2-3 minutes of bench rest represent glycolytic-dominant energy demands. Conditioning should use high-intensity intervals of matching duration (45-60 seconds) with corresponding rest periods (2-3 minutes) to develop the specific glycolytic capacity needed for sustained high-intensity skating during each shift.

162. C — An advanced athlete with extensive training experience preparing for a single major competition requires block periodization's concentrated, precisely targeted training stimuli. The accumulation → transmutation → realization sequence allows the specialist to control the training emphasis in each block with precision, timing the realization (peaking) phase to produce optimal performance at the specific competition date.

163. A — The principle of accommodation predicts that the response to a constant, unchanging stimulus diminishes over time as the body fully adapts to that specific stress. After 22 weeks of identical programming, introducing variation in exercises, loads, volumes, or the periodization model provides novel stimuli that the body has not yet adapted to, overcoming the plateau and restarting the progressive adaptation process.

164. D — Reconditioning after hamstring surgery follows a systematic progression: low-intensity range of motion restoration → progressive resistance training at gradually increasing loads → sport-specific movement integration (sprinting, cutting, acceleration) → unrestricted return to competition upon meeting objective bilateral symmetry criteria (within 10% on relevant strength and functional tests) with formal medical clearance.

165. B — Block periodization for powerlifting sequences: accumulation (high volume at moderate intensity for structural development and work capacity), transmutation (higher intensity for converting structural gains into sport-specific maximal strength), and realization (low volume at very high intensity for peaking the squat, bench press, and deadlift at the competition date). Each block builds upon the adaptations of the preceding one.

166. C — Muscular endurance training uses rest periods of 30 seconds or less to maintain elevated metabolic demand and cardiovascular stress throughout the training session. Short rest prevents full metabolic recovery between sets, forcing the muscles to sustain work under progressive fatigue. This incomplete recovery trains the specific adaptation of fatigue resistance that defines muscular endurance.

167. A — Five sets of 2 repetitions at 93% of 1RM with 5-minute rest is a maximal strength and neural adaptation protocol. The near-maximal loading ensures recruitment of the highest-threshold motor units, and the complete rest between sets allows full phosphocreatine recovery and neural restoration for maximal force production on every repetition — the essential stimulus for neural strength development.

168. D — Volume load = sets × repetitions × load = 5 × 5 × 140 = 3,500 kg. This standard calculation quantifies the total mechanical work performed in a given exercise, providing the objective metric needed for tracking progressive overload across training phases, comparing relative training stress between sessions, and managing accumulated fatigue within a periodized program.

169. B — Novice athletes benefit most from moderate loads (60-70% of estimated 1RM) with higher repetitions (10-15 per set) during the initial 4-6 weeks of training. This approach develops movement proficiency through multiple repetitions, builds initial work capacity, allows connective tissue time to adapt to new loading, and establishes the neural and structural foundation needed for heavier loading in subsequent training phases.

170. C — The 48-72 hour recovery requirement between plyometric sessions allows adequate recovery of the musculotendinous structures that experience significant eccentric loading during plyometric exercises. Tendons and connective tissues have lower metabolic activity and blood supply than muscle tissue, requiring more time for the collagen synthesis and structural remodeling needed to adapt to high-impact training. Insufficient recovery increases overuse injury risk.

171. A — Progressive increases in intensity (70% → 78% → 83% → 89%) with corresponding decreases in volume (4×8 → 4×6 → 4×5 → 4×3) across sequential 2-week phases is the defining characteristic of linear periodization. Each phase builds on the preceding one, systematically moving from higher-volume, moderate-intensity training toward lower-volume, higher-intensity training in preparation for maximal performance.

172. 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 within the same week addresses both ends of the force-velocity continuum. Heavy loads develop the high-force end (maximal strength), while explosive exercises develop the high-velocity end (speed-strength and power). Both qualities are essential for sprinting performance.

173. B — A deload week after three consecutive loading weeks manages accumulated fatigue 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 — setting up the athlete for productive training during the next loading cycle.

174. D — This combination directly addresses all identified needs: rowing-specific aerobic conditioning develops the endurance base for 2000-meter race demands, barbell rows and pull-ups develop the upper body pulling strength driving each stroke, anti-extension and anti-rotation core exercises develop trunk stability for efficient force transfer, and front squats and Romanian deadlifts develop the lower body drive power that initiates the rowing stroke.

175. A — Three-minute rounds of sustained high-intensity fighting fall within the glycolytic-dominant duration range (approximately 30 seconds to 3 minutes at near-maximal intensity). The glycolytic system provides the primary ATP contribution during each round, while the phosphagen system

powers individual explosive techniques (punches, kicks, takedowns), and the aerobic system supports recovery during the 1-minute rest periods between rounds.

176. 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 and manage fatigue, maintaining intensity at preparatory-period levels preserves the neural and muscular adaptations that underpin strength and power performance.

177. B — The correct annual training plan sequence is: general preparation (building a broad fitness base) → specific preparation (developing sport-specific qualities) → competition (peaking and performance maintenance) → transition (recovery and restoration). Each period builds systematically upon the preceding one, progressing from broad foundational fitness through increasingly specific competitive preparation.

178. C — Four sets of 12 repetitions at 70% of 1RM with 60-second rest periods is a classic hypertrophy protocol. The moderate load provides sufficient mechanical tension for muscle growth, the higher repetition range and short rest periods create metabolic stress (lactate accumulation, hydrogen ion concentration, reduced pH), and the combined stimulus drives the protein synthesis signaling cascade responsible for muscle hypertrophy.

179. A — A decathlete competing in 10 events over 2 days requires simultaneous development of sprint speed, endurance, jumping power, throwing power, and multiple technical skills — an unusually broad range of physical qualities. Concurrent training with undulating periodization provides the framework for addressing all these qualities in parallel throughout the training year without the concentrated detraining of neglected qualities that block periodization would produce.

180. D — Belt squats, leg press, goblet squats with modified grip, and other lower body exercises that do not require a conventional barbell grip allow continued lower body training while accommodating the wrist injury. Eliminating all lower body training leads to unnecessary detraining of the uninjured limbs, and attempting barbell exercises with an injured wrist risks further damage and compensation patterns.

181. B — A soccer goalkeeper's explosive diving saves and short sprints (2-5 seconds) represent phosphagen-dominant efforts with variable, unpredictable rest periods between actions. Work-to-rest ratios of 1:8 to 1:12 allow near-complete phosphocreatine recovery between explosive efforts, ensuring maximal-quality performance on each action. This matches the variable, explosive demands of the goalkeeping position.

182. C — The general preparation phase builds a broad foundation of hypertrophy (increasing muscle cross-sectional area), general strength (developing multi-joint force production), work capacity (tolerance for training volume), and aerobic fitness (cardiovascular base). This foundation uses a variety of exercises and training methods to prepare the body for the more specific, intense training that follows during specific preparation.

183. A — During specific preparation, the training emphasis shifts from general fitness to sport-specific qualities including explosive power, maximum speed, agility and change-of-direction ability, and sport-specific metabolic conditioning. Exercise selection becomes more targeted toward the demands identified in the needs analysis, and training methods more closely replicate the competitive environment.

184. D — DUP provides more frequent exposure to different training stimuli within each training week, preventing the accommodation that occurs with prolonged exposure to a single training zone. By cycling through hypertrophy, strength, and power sessions within the same week, the athlete receives regular stimulus for all three qualities simultaneously — the primary advantage over linear models that address each quality sequentially.

TESTING AND EVALUATION (Questions 185–206)

185. B — The vertical jump (countermovement jump) using a Vertec device is the most practical and valid field assessment of lower body explosive power for this scenario. It is valid (directly measures the power quality being assessed), reliable (produces consistent results with standardized protocols), practical for large-group testing (multiple athletes can be tested efficiently), and requires minimal equipment.

186. C — Reliability is the psychometric property defined by consistent, reproducible scores across repeated administrations under identical conditions. A reliable test produces similar results when the same athlete is tested multiple times without a true change in fitness level. High reliability ensures that observed score changes between testing sessions can be attributed to actual performance improvement rather than measurement variability.

187. A — The 1RM is defined as the last weight successfully lifted with acceptable technique through the full range of motion. The athlete completed 150 kg with proper form but failed at 155 kg, so 150 kg is the recorded 1RM. Failed attempts are never counted as the 1RM regardless of how close to completion they were, because the technical and safety standards were not met.

188. D — The 12 cm difference between the CMJ (65 cm) and SJ (53 cm) reflects the athlete's stretch-shortening cycle utilization — the contribution of stored elastic energy in the musculotendinous unit and the stretch reflex from muscle spindle activation during the rapid countermovement. These SSC mechanisms augment concentric force production during the CMJ takeoff, adding power that is unavailable during the static squat jump.

189. B — The 20-meter multistage shuttle run (beep test) requires only cones and a sound system, can be administered to large groups simultaneously, and provides a valid estimate of aerobic capacity through an externally paced, progressive-intensity protocol. Its practical advantages — minimal equipment, group administration, and standardized pacing — make it the optimal choice for the described outdoor testing scenario.

190. C — The skinfold body composition calculation involves two sequential steps: first, skinfold thicknesses are entered into population-specific prediction equations to estimate body density; then, body density is converted to body fat percentage using conversion equations such as the Siri equation (% BF = [495 ÷ body density] – 450). Both steps are required — skinfold measurements do not directly produce body fat percentage.

191. A — Bioelectrical impedance analysis estimates body composition by passing a low-level electrical current through the body and measuring impedance. Hydration status significantly affects this measurement 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 body fat — potentially by several percentage points.

192. D — Electronic timing gates eliminate the human timer's reaction time variability, which introduces approximately 0.1-0.3 seconds of error per measurement. In short sprints (10-40 yards), this error can represent a substantial proportion of total sprint time and may obscure real performance differences between athletes. Electronic systems provide consistent, accurate timing free from human bias and reaction delay.

193. B — A 20% 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 or incomplete rehabilitation contributing to the persistent deficit.

194. C — The vertical jump at the 31st percentile is disproportionately low relative to the 85th percentile squat strength, indicating a rate of force development deficit. The athlete has adequate maximal force production capacity but cannot express it rapidly enough for explosive performance. Programming should prioritize explosive training (plyometrics, Olympic lifts, jump squats) to develop rapid force production.

195. A — Using identical testing conditions across both pre- and post-testing sessions — same warmup protocol, same equipment, same test order, same time of day, same environmental conditions, and same verbal instructions — is the most critical standardization factor. Any variation between sessions introduces confounding variables that may be incorrectly interpreted as performance changes rather than procedural inconsistencies.

196. D — At 87% bilateral symmetry, the surgical leg has not yet met the commonly cited 90% threshold required for return-to-play consideration following ACL reconstruction. The athlete should continue progressive strengthening of the quadriceps and hamstrings until the symmetry criterion is achieved, because persistent asymmetries below 90% are associated with elevated re-injury risk.

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 set

enables detailed analysis of the jump performance that simpler methods cannot provide — the Vertec measures only reach height, and jump mats measure only flight time.

198. C — The sit-and-reach test primarily measures hamstring and lower back flexibility, does not assess range of motion at other joints (shoulder, hip, ankle, thoracic spine), 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 information.

199. A — 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 test cannot detect. This specificity enables targeted intervention — if goniometry reveals a hip flexion restriction, specific hip stretches can be prescribed rather than generic hamstring flexibility work.

200. D — Testing at the beginning and end of each major training phase (pre-season, mid-season, post-season) provides sufficient data points for tracking longitudinal progress, evaluating program effectiveness, and identifying persistent deficiencies that require programming modification — all without excessive disruption to the training schedule from overly frequent testing.

201. B — Submaximal 1RM prediction equations are most accurate when the repetitions completed fall within 10 or fewer, because the relationship between submaximal repetitions and true 1RM becomes increasingly non-linear at higher repetition counts. At rep ranges above 10, factors such as muscular endurance, pain tolerance, and psychological motivation introduce variability that the prediction equations cannot account for, increasing estimation error.

202. C — The standardized 1RM testing protocol includes approximately 3-4 progressively heavier warmup sets at approximately 50%, 70%, and 80-85% of estimated 1RM before beginning single-repetition maximal attempts. This progressive loading systematically prepares the neuromuscular system, increases tissue temperature, and rehearses the movement pattern at incrementally higher intensities before the athlete attempts near-maximal loads.

203. A — The T-test involves a forward sprint of 10 yards to a center cone, lateral shuffle 5 yards to one side, lateral shuffle 10 yards to the opposite side, lateral shuffle 5 yards back to center, and backward run 10 yards to the start — arranged in a T-shaped pattern covering approximately 40 total yards. It assesses multidirectional movement ability including forward, lateral, and backward capabilities.

204. D — If plyometric training alone has not improved vertical jump after 12 weeks, the athlete's squat at only 1.1× body weight falls below the commonly recommended 1.5× body weight threshold for plyometric effectiveness. Heavy resistance training should be added to develop the strength foundation that enables plyometrics to produce further power gains. Without adequate strength, the SSC cannot be effectively loaded during plyometric exercise.

205. B — Both the Cooper 12-minute run and the 1.5-mile run require the athlete to self-pace at maximal effort for the entire test duration. Performance depends heavily on the athlete's motivation, pacing experience, and willingness to tolerate sustained high-intensity discomfort. Athletes unfamiliar with self-pacing strategies or lacking competitive motivation may produce results that significantly underestimate their true aerobic capacity.

206. C — A comprehensive pre-season basketball testing battery should assess aerobic capacity (shuttle run or 1.5-mile run), sprint speed (lane sprints or 20-yard dash), agility and change of direction (T-test or pro agility), lower body power (vertical jump), upper body strength (bench press or push-up test), and body composition (skinfolds or BIA). These domains align with the diverse physical demands of competitive basketball.

ORGANIZATION AND ADMINISTRATION (Questions 207–220)

207. A — Using the NSCA's minimum guideline of 40 square feet per athlete: 50 athletes × 40 sq ft = 2,000 square feet of minimum usable training floor space. Using the upper guideline of 60 square feet per athlete: 50 × 60 = 3,000 square feet. The absolute minimum is 2,000 square feet, with 3,000 providing more comfortable spacing and equipment accommodation.

208. D — Emergency action plans should be rehearsed at least annually with all staff members participating, and ideally more frequently (quarterly or semi-annually). Unrehearsed plans fail under the stress of actual emergencies because staff members may not know their assigned roles, equipment locations, communication procedures, or the fastest route for directing EMS to the facility.

209. B — CPR and AED certification from a recognized provider (American Heart Association, American Red Cross, or equivalent) ensures that every CSCS-credentialed professional can provide immediate life-saving intervention for cardiac emergencies occurring in the training environment. Cardiac arrest survival rates decline approximately 7-10% for every minute without CPR and defibrillation, making this competency critical.

210. C — 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 — not perfection, but the baseline that the profession considers acceptable for safe and effective practice.

211. A — A signed waiver generally does not protect the facility against claims of gross negligence or reckless conduct — willful disregard for participant safety that goes substantially beyond ordinary carelessness. While a waiver documents that inherent risks were disclosed and voluntarily assumed by the participant, it cannot absolve a professional who demonstrates conduct so far below the standard of care that it constitutes recklessness.

212. D — Diagnosing musculoskeletal conditions and prescribing rehabilitation exercises are functions that fall entirely outside the CSCS scope of practice, requiring the training and licensure of medical

professionals — physicians, athletic trainers, or physical therapists. The specialist must refer the athlete to the appropriate qualified provider while continuing to manage the non-rehabilitative aspects of the training program.

213. B — The CSCS scope of practice encompasses designing periodized annual training programs based on needs analyses, teaching proper exercise technique, administering standardized performance assessments, and managing the strength and conditioning facility. Diagnosing injuries, prescribing rehabilitation, creating individualized meal plans with specific caloric targets, and providing psychological counseling all require separate professional credentials and licensure.

214. C — Equipment that shows visible signs of damage, excessive wear, or mechanical malfunction must be immediately removed from service, tagged as out of order to prevent inadvertent use, documented in the maintenance log with a description of the issue, and repaired or replaced by qualified personnel before being returned to use. Continued use of damaged equipment violates the duty to maintain a safe training environment and dramatically increases liability.

215. A — The NSCA's professional standards require the CSCS-credentialed professional to decline implementing practices that conflict with evidence-based safety principles, explain the scientific rationale to the sport coach, and advocate for the athletes' safety and wellbeing. The certified professional holds ultimate responsibility for the strength and conditioning program and cannot defer that responsibility to coaches who lack the specialized training in exercise science and safety.

216. D — Supervision ratios should be adjusted based on three primary factors: the complexity and risk level of the exercises being performed (Olympic lifts require closer supervision than machines), the experience level of the athletes being supervised (novices require more guidance and monitoring), and the qualifications of the available supervisory staff (more experienced staff can safely manage larger groups).

217. B — Comprehensive record keeping should include athlete training logs and program documentation, performance testing data, signed liability waivers, medical clearance forms, equipment inspection and maintenance records, and incident/injury reports. These documents serve dual purposes: supporting effective evidence-based programming decisions and providing legal documentation of standard of care and informed consent if claims arise.

218. C — An unqualified colleague independently teaching heavy power cleans to inexperienced athletes creates significant safety and liability risk for both the athletes and the institution. The concern must be addressed immediately through appropriate professional channels — discussing the issue directly with the colleague and escalating to supervisory staff if necessary to ensure that technically demanding exercises are taught only by qualified personnel.

219. A — Facility footwear policies requiring closed-toe athletic shoes exist to protect athletes from injury caused by dropped weights, rolling barbells, and equipment contact. Open-toed sandals provide zero foot protection against these hazards. The policy must be enforced consistently for all athletes — the athlete cannot train until they return with proper closed-toe athletic footwear.

220. D — The NSCA's professional standards establish that the CSCS-credentialed professional 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 for integrating strength training with sport practice, the certified professional makes final decisions about program design, exercise selection, loading, and safety based on their specialized expertise in exercise science.