PRACTICE EXAM 11: CSCS FULL-LENGTH SIMULATION

SECTION 1 — SCIENTIFIC FOUNDATIONS

95 Questions | 1.5 Hours Recommended

EXERCISE SCIENCE (Questions 1–52)

1. A 20-year-old collegiate sprinter undergoes muscle biopsy before and after 18 months of combined heavy resistance and speed training. The most consistently documented fiber type change expected in the post-training biopsy is which of the following?

A. Conversion of Type I to Type IIx fibers

B. Complete elimination of all Type II fibers

C. Reduction in Type IIx with a proportional increase in Type IIa

D. No measurable change in any fiber type proportions

2. During the sliding filament mechanism, actin is pulled toward the center of the sarcomere during the power stroke. Which band of the sarcomere narrows as the thin filaments slide inward while the A-band remains constant?

A. The I-band

B. The A-band

C. The M-line

D. The Z-line thickness

3. An experienced lifter with 5 years of training increases bench press 1RM by only 4% over a 16-week program, but ultrasound reveals an 11% increase in pectoral cross-sectional area. This adaptation pattern is best explained by which principle?

A. Neural adaptation dominates at all training stages

B. Hypertrophy always precedes neural adaptation

C. The lifter has reached an absolute physiological ceiling

D. Advanced trainees rely more on structural hypertrophy because neural adaptations are largely maximized

4. During excitation-contraction coupling, calcium released from the sarcoplasmic reticulum binds to which regulatory protein to expose the myosin binding sites on actin?

A. Myosin heavy chain

B. Troponin C

C. Titin

D. Desmin

5. An athlete performs a maximal isometric mid-thigh pull on a force plate. Peak force is 3,800 N reached at 180 milliseconds. The average rate of force development is which value?

A. 21,111 N/s (3,800 ÷ 0.180)

B. 3,800 N/s

C. 684 N/s

D. Cannot be calculated from these data

6. According to Henneman's Size Principle, which motor unit type is recruited last as force demand increases toward maximal effort?

A. Type I motor units with the lowest firing thresholds

B. Type IIa motor units with moderate thresholds

C. All motor units are recruited simultaneously at every load

D. Type IIx motor units with the highest firing thresholds

7. The Golgi tendon organ produces autogenic inhibition through which neural pathway?

A. A monosynaptic excitatory connection to the alpha motor neuron

B. An Ib inhibitory interneuron that reduces alpha motor neuron activity to the same muscle

C. Direct excitation of the muscle spindle gamma motor neurons

D. A polysynaptic pathway through the cerebral cortex

8. An exercise physiologist measures VO_2 during a graded treadmill test. At stage 10, VO_2 reaches 56 mL/kg/min and does not increase at stages 11 or 12 despite increased speed and grade. RER is 1.18 and HR is within 4 bpm of age-predicted max. This confirms which measure?

A. The lactate threshold at 56 mL/kg/min

B. The ventilatory threshold

C. VO_2max at 56 mL/kg/min

D. Resting metabolic rate

9. A 30-second maximal sprint on a cycle ergometer produces blood lactate of 15 mmol/L and severe quadriceps burning. Which energy system dominated this effort?

A. Anaerobic glycolysis

B. Oxidative phosphorylation through fat metabolism

C. The phosphagen system exclusively for the entire 30 seconds

D. Beta-oxidation of intramuscular triglycerides

10. An athlete's RER during a 3.5-hour ride at 63% VO_2max decreases from 0.87 to 0.77. This shift indicates which metabolic change?

A. Increased reliance on anaerobic glycolysis

B. Increased protein catabolism as the sole fuel

C. No meaningful change in substrate utilization

D. Greater reliance on fat oxidation as glycogen depletes

11. The Krebs cycle occurs in which cellular location?

A. The sarcoplasm outside the mitochondria

B. The mitochondrial matrix

C. The sarcolemma surface

D. The sarcoplasmic reticulum

12. Fat oxidation cannot fuel high-intensity exercise primarily because of which limitation?

A. Fat stores are too small for meaningful energy

B. Fat molecules cannot physically enter mitochondria

C. The rate of ATP production from fat is too slow for high-intensity demands

D. Fat produces toxic byproducts at high intensities

13. A cyclist's blood glucose drops to 46 mg/dL after 4 hours at 65% VO_2max. The primary cause of the resulting performance decline is which event?

A. Glycogen depletion and hypoglycemia limiting carbohydrate substrate availability

B. Phosphocreatine depletion from the aerobic cycling effort

C. Hydrogen ion accumulation from steady-state moderate-intensity exercise

D. Complete protein catabolism destroying all contractile tissue

14. During progressive exercise testing, stroke volume plateaus at approximately 40-60% of VO_2max. Further increases in cardiac output beyond this point depend primarily on which variable?

A. Continued ventricular chamber enlargement during the test

B. Progressive blood volume decreases concentrating oxygen delivery

C. Increased blood viscosity forcing faster circulation through tissues

D. Continued heart rate increases via sympathetic nervous system activation

15. An athlete produces 3,100 N of vertical GRF during a jump. Body weight is 833 N (85 kg). Net upward force is 2,267 N. Using F=ma, the upward acceleration is approximately which value?

A. 3,100 m/s^2 using total GRF without subtracting body weight

B. 26.7 m/s^2 (2,267 ÷ 85)

C. 0 m/s^2 because GRF equals body weight

D. Acceleration cannot be calculated from force and mass

16. A biomechanical analysis reveals that during a barbell curl, the biceps must produce approximately 8 times the external load to overcome the resistance. This force multiplication requirement exists because of which lever characteristic?

A. The biceps insertion is farther from the elbow than the dumbbell

B. First-class lever arrangement at the elbow joint

C. Third-class lever with effort arm much shorter than resistance arm

D. Second-class lever creating mechanical advantage

17. The bicarbonate buffering system generates additional CO_2 when neutralizing hydrogen ions from glycolysis. This additional CO_2 triggers disproportionate ventilation increases that define which threshold?

A. The ventilatory threshold

B. The phosphocreatine recovery threshold

C. The fat oxidation threshold

D. The protein deamination threshold

18. During a plyometric depth jump, an athlete's amortization phase increases from 170 ms to 360 ms by the sixth repetition. The appropriate coaching response is which of the following?

A. Increase box height to force faster transitions

B. Add ankle weights for greater eccentric loading

C. Continue to 15 reps to accumulate fatigue-based adaptation

D. Terminate the exercise because SSC benefit has been lost

19. At maximum sprint velocity, ground contact times are approximately 80-100 ms. The GRF component that most distinguishes faster sprinters from slower ones is which of the following?

A. The anteroposterior (horizontal) component

B. The vertical component

C. The mediolateral component

D. All three components equally

20. Eccentric cardiac hypertrophy from chronic endurance training directly increases which cardiovascular variable?

A. Resting diastolic blood pressure

B. Blood viscosity

C. Maximal stroke volume

D. Resting sympathetic tone

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

A. Local metabolic vasodilation in working muscles plus sympathetic vasoconstriction in non-essential organs

B. Decreased total cardiac output concentrating blood volume

C. Permanent closure of vessels to the brain and organs

D. Increased blood viscosity forcing flow to active tissue

22. A resistance protocol of 4×10 at 72% 1RM with 60-second rest produces greater acute GH than 5×2 at 92% with 5-minute rest. The primary stimulus for this GH difference is which factor?

A. Heavier absolute loading in the high-volume protocol

B. Greater training time in the strength protocol

C. Superior neural recruitment from lighter loads

D. Higher metabolic stress from incomplete recovery between sets

23. Testosterone-to-cortisol ratio has declined for 7 consecutive weeks alongside performance stagnation, elevated resting HR, insomnia, and persistent fatigue. This presentation indicates which condition?

A. Optimal competitive peaking and readiness

B. Overtraining syndrome

C. Normal training-induced hormonal fluctuation

D. Acute delayed-onset muscle soreness

24. A female athlete's testosterone is approximately 10-15 times lower than a male counterpart's. Female athletes still achieve significant strength gains primarily through which mechanism?

A. Greater GH production compensating for lower testosterone

B. Enhanced flexibility directly increasing force production

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

D. Superior bone mineral density replacing hypertrophy

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

A. Ground-based resistance exercises with compressive and impact loading

B. Deep-water aquatic exercise with full buoyancy support

C. Recumbent cycling at very low intensity

D. Seated machine exercises with very light resistance

26. Two athletes share a 185 kg squat 1RM. Athlete A jumps 69 cm; Athlete B jumps 52 cm. The 17 cm difference despite equal maximal strength is best explained by which quality?

A. Superior aerobic capacity in Athlete A

B. Greater absolute strength in Athlete A

C. Greater flexibility in Athlete A

D. Superior rate of force development and power output in Athlete A

27. A strength and conditioning specialist calculates torque: 9 kg dumbbell at 90° shoulder abduction, 0.60 m from joint to dumbbell center. The torque is approximately which value?

A. 9 N·m

B. Approximately 53 N·m (9 × 9.81 × 0.60)

C. 0 N·m

D. 200 N·m

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

A. Vasoconstriction in all vascular beds

B. Increased blood viscosity maintaining pressure

C. Vasodilation in working muscles reducing peripheral resistance

D. Decreased cardiac output during the diastolic phase

29. A female distance runner presents with amenorrhea for 10 months, 1,100 kcal/day intake with 3 hours daily training, decreased lumbar BMD on DEXA, and two recent stress fractures. This presentation indicates which condition?

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

B. Iron deficiency anemia

C. Normal adaptation to endurance training

D. Vitamin D toxicity

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

A. Stimulating muscle protein synthesis via mTOR

B. Enhancing glycogen synthesis in skeletal muscle

C. Suppressing all lipolysis regardless of exercise duration

D. Mobilizing amino acids for gluconeogenesis to maintain blood glucose

31. Chronic resistance training increases androgen receptor density in skeletal muscle. The practical significance is which of the following?

A. No effect on the muscle's hormonal response

B. Enhanced muscle sensitivity to circulating testosterone

C. Eliminated need for adequate sleep and nutrition

D. Reversal within 24 hours of any training cessation

32. The crossover concept describes which metabolic phenomenon?

A. Conversion of fast-twitch fibers to slow-twitch

B. Transfer of training from one limb to the contralateral limb

C. Progressive shift from fat to carbohydrate oxidation as exercise intensity increases

D. Transition from aerobic to anaerobic threshold

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

A. The liver

B. The kidneys

C. The spleen

D. The pancreas

34. The phosphagen system produces ATP faster than any other system because the creatine kinase reaction has which characteristic?

A. It requires complex mitochondrial processing

B. It operates exclusively within the mitochondria

C. It requires oxygen as an essential co-factor

D. It is a single-step enzymatic reaction in the sarcoplasm requiring no oxygen

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

A. Muscle spindle facilitation increasing contraction

B. GTO autogenic inhibition reducing muscle tone

C. Pacinian corpuscle vibration detection

D. Ruffini ending pressure sensing at the joint

36. The "muscle memory" phenomenon allowing faster retraining after detraining is explained by which mechanism?

A. Permanently elevated creatine kinase levels

B. Residual glycogen stores lasting years

C. Retained myonuclei from prior training persisting through atrophy

D. Circulating testosterone remaining elevated indefinitely

37. Detraining research shows which physiological quality declines most rapidly after cessation of training?

A. Maximal strength within 24 hours

B. Bone mineral density within 5 days

C. Flexibility permanently within 48 hours

D. Aerobic capacity (VO_2max) within 1-2 weeks

38. An athlete's passive hip flexion is 140° and active hip flexion is 118°. The 22° difference reflects which principle?

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

B. A structural bone abnormality at the hip joint

C. A complete hip flexor tear on the tested side

D. Goniometer calibration error of 22°

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

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

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

C. Equal force and speed at all ankle joint angles

D. Zero mechanical advantage in any direction

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

A. Identical metabolic activity and blood supply to muscle

B. Higher metabolic rate than surrounding muscle tissue

C. No capacity for any structural remodeling

D. Lower metabolic activity and reduced blood supply

41. During moderate-intensity exercise, systolic blood pressure increases progressively. Pulse pressure (systolic minus diastolic) widens because of which mechanism?

A. Decreased cardiac contractility reducing stroke volume

B. Vasoconstriction in working muscles increasing resistance

C. Increased stroke volume elevating systolic while vasodilation stabilizes diastolic

D. Decreased heart rate reducing cardiac output

42. An athlete's hormonal profile after 14 weeks of training shows stable testosterone, decreased cortisol, improved T:C ratio, and continued performance gains with adequate sleep. This indicates which status?

A. Successful positive adaptation

B. Advanced overtraining syndrome

C. Underlying medical condition

D. Meaningless hormonal data

43. Chronic heavy resistance training can increase an athlete's voluntary activation from approximately 70% to 90% of the motor unit pool. This improvement is primarily explained by which adaptation?

A. Complete structural regeneration of all motor neurons

B. Reduced GTO inhibition and improved central drive

C. Elimination of all Type I fibers from the trained muscle

D. EMG equipment artifact requiring recalibration

44. A strength and conditioning specialist evaluates a program for a competitive high jumper consisting only of heavy bilateral squats at slow tempos. This violates SAID because it fails to develop which demands?

A. Only bilateral strength is needed for the high jump

B. Only flexibility determines high jump performance

C. Only cardiovascular endurance matters for jumping

D. Unilateral takeoff power, rapid RFD, SSC mechanics, and approach speed

45. The force-velocity relationship shows that peak power occurs at approximately which region of the curve?

A. Maximum force at zero velocity

B. Maximum velocity at zero load

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

D. Power is equal at every point on the curve

46. During sprint acceleration (first 10-30 meters), a pronounced forward lean allows the athlete to do which of the following?

A. Direct GRF primarily horizontally to generate forward momentum

B. Maximize vertical flight time between strides

C. Establish mediolateral balance before top speed

D. Body lean has no effect on force direction

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

A. A polysynaptic reflex through the cerebral cortex

B. A monosynaptic reflex — the fastest possible reflexive contraction

C. A voluntary cortical contraction requiring conscious processing

D. An inhibitory reflex reducing muscle force production

48. An athlete performs a CMJ achieving 64 cm and SJ achieving 52 cm. The 12 cm difference represents the contribution of which mechanism?

A. Greater phosphocreatine availability during the CMJ

B. Enhanced aerobic energy during the countermovement

C. Reduced bodyweight at the transition between phases

D. The stretch-shortening cycle

49. A force plate test shows two athletes at 88 kg each producing 3,000 N peak GRF. Athlete A reaches peak in 135 ms; Athlete B in 275 ms. Athlete A jumps higher because of which quality?

A. Greater absolute strength in Athlete A

B. Superior aerobic capacity in Athlete A

C. Superior rate of force development producing greater impulse

D. Greater flexibility in Athlete A

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

A. Elastic energy dissipates as heat and stretch reflex contribution diminishes

B. The stretch reflex is amplified producing greater power

C. Concentric force production is enhanced

D. The musculotendinous unit becomes stiffer improving energy return

51. A 16-week detraining study shows that an athlete who previously trained for 5 years regains strength faster than a matched subject who never trained. This "muscle memory" effect is attributed to which mechanism?

A. Elevated circulating testosterone persisting after training cessation

B. Residual muscle glycogen stores remaining indefinitely

C. Permanently elevated creatine kinase enzyme activity

D. Retained myonuclei that accelerate protein synthesis upon retraining

52. An athlete performs a maximal Valsalva maneuver during a 1RM squat. Blood pressure spikes to 350/280 mmHg. This acute response is generally tolerated by healthy athletes but poses serious risk for which population?

A. Trained competitive powerlifters with medical clearance

B. Individuals with uncontrolled hypertension or cardiovascular disease

C. Collegiate athletes performing supervised compound lifts

D. Military personnel during occupational fitness testing

SPORT PSYCHOLOGY (Questions 53–75)

53. An athlete reports pre-competition muscle tension, elevated HR, shallow breathing, and sweaty palms. These symptoms classify as which anxiety type?

A. Cognitive anxiety from negative thought patterns

B. Trait anxiety as a permanent disposition

C. Somatic anxiety — physiological activation symptoms

D. Facilitative arousal enhancing performance

54. The inverted-U hypothesis predicts that a precision free-throw shooter should aim for which arousal level?

A. Low-to-moderate arousal for fine motor control and focus

B. Very high arousal for maximum muscle activation

C. High arousal identical to a maximal tackle

D. Arousal is irrelevant to free-throw accuracy

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

A. It is a global personality trait across all domains

B. It is determined exclusively by genetic factors

C. It is identical to general confidence in all respects

D. It is task-specific and situation-specific

56. A coach says: "You jumped 78 cm on that vertical." This feedback provides which type of information?

A. Knowledge of performance about technique quality

B. Knowledge of results about the movement outcome

C. Intrinsic feedback from proprioceptive senses

D. Motivational feedback to increase future effort

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

A. Faster initial improvement and better retention simultaneously

B. Identical outcomes because structure doesn't affect learning

C. Slower initial improvement but better long-term retention

D. Faster improvement with identical long-term retention

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

A. Impaired learning from dependency on external correction

B. Optimal permanent learning from maximum information

C. Accelerated mastery persisting indefinitely

D. No measurable effect on skill acquisition

59. Distributed practice (shorter sessions with rest) 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. Massed practice produces zero learning under any conditions

D. Memory consolidation during rest intervals between sessions

60. An athlete in Fitts and Posner's cognitive stage demonstrates which characteristics?

A. Automatic execution with attention free for strategic monitoring

B. Large frequent errors with heavy reliance on verbal instruction

C. Smooth consistent technique with minimal conscious thought

D. Self-correcting performance with occasional minor errors

61. Athletic burnout is characterized by which three dimensions?

A. Increased motivation, energy, and competitive drive

B. Normal mood fluctuation resolving within hours

C. Emotional exhaustion, depersonalization, and reduced accomplishment

D. Acute pre-competition anxiety resolving after events

62. A 17-year-old athlete shows increasing isolation, persistent feelings of worthlessness, lost interest in activities, and expressed hopelessness. The specialist should do which of the following?

A. Recommend parents seek professional mental health evaluation

B. Design a more intense training program for confidence

C. Increase competitive schedule for more success

D. Ignore the behavior as normal adolescent development

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

A. Strength, power, and endurance

B. Visual, kinesthetic, and auditory processing

C. Outcome, performance, and process achievement

D. Autonomy, competence, and relatedness

64. An athlete watches a teammate of similar ability complete a challenging lift they've been hesitant to attempt. The resulting confidence increase comes from which self-efficacy source?

A. Past performance accomplishment

B. Vicarious experience

C. Verbal persuasion from the coaching staff

D. Physiological state interpretation

65. An athlete consistently excels in practice but underperforms in competition, reporting intense worry and disruptive self-talk. This pattern indicates which phenomenon?

A. Social facilitation enhancing performance

B. Optimal arousal producing best output

C. Choking under pressure from excessive cognitive anxiety

D. A permanent condition preventing all competitive success

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

A. Refer to a qualified healthcare professional for evaluation

B. Prescribe a corrective meal plan

C. Increase body composition testing frequency

D. Ignore as normal wrestling culture

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

A. Enhanced performance from metabolic efficiency

B. Increased testosterone from adaptive caloric restriction

C. No health consequences in males

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

68. An ACL reconstruction patient fears re-injury during cutting drills despite full medical clearance. The most appropriate response is which of the following?

A. Immediate return to full-contact competition

B. Gradual movement reintroduction with sport psychology referral

C. Permanent elimination of all cutting movements

D. Dismissal of psychological concerns as irrelevant

69. When a pitcher throws a fastball then a changeup using the same arm action, which GMP parameter changes while invariant features remain constant?

A. Relative timing of all muscle activations

B. The fundamental spatial pattern of the throwing trajectory

C. Overall speed and absolute force of execution

D. Nothing changes because the GMP is fixed

70. A point guard scanning the entire court for open teammates uses which attentional focus?

A. Broad-external focus

B. Narrow-external focus

C. Broad-internal focus

D. Narrow-internal focus

71. An athlete successfully squats 195 kg for the first time and reports increased confidence for 200 kg. Which self-efficacy source is primarily responsible?

A. Vicarious experience

B. Verbal persuasion

C. Physiological state interpretation

D. Past performance accomplishment

72. Motor learning research shows that reducing feedback frequency from 100% to approximately 50% of trials produces which effect?

A. Slower acquisition during practice sessions

B. Better long-term retention by forcing internal error detection

C. Identical outcomes regardless of feedback frequency

D. Permanent impairment of all motor learning

73. Somatic anxiety symptoms (tension, elevated HR, breathing changes) are best addressed by which intervention?

A. Thought stopping and cognitive restructuring

B. Goal-setting worksheets and planning

C. Physical relaxation techniques such as PMR and diaphragmatic breathing

D. Mental imagery of worst-case failure scenarios

74. Transfer of training is highest when two skills share common movement features. Front squats transferring to the power clean catch is which type?

A. Positive transfer

B. Negative transfer

C. Zero transfer

D. Random unpredictable transfer

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

A. Only the visual modality with all others suppressed

B. Only kinesthetic feel with no visual component

C. Only auditory sounds of the competition environment

D. Visual, kinesthetic, auditory, and emotional components simultaneously

NUTRITION (Questions 76–95)

76. A 95 kg athlete at 2.2 g/kg/day requires which daily protein target?

A. 76 grams

B. 209 grams

C. 475 grams

D. 38 grams

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

A. Glutamine

B. Glycine

C. Leucine

D. Alanine

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

A. Inadequate fat impairing steroid hormone production

B. Excessive protein intake causing renal stress

C. Excessive carbohydrate causing insulin resistance

D. Chronic dehydration mimicking hormone suppression

79. An athlete consumes only plain water at 2.5 L/hr for 5 hours during an ultramarathon without sodium replacement. The resulting confusion is caused by which condition?

A. Hypernatremia from sodium concentration

B. Metabolic alkalosis from water pH

C. Rhabdomyolysis from muscle damage

D. Exercise-associated hyponatremia from sodium dilution

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

A. 24-48 hours

B. 28 days

C. Impossible without the loading phase

D. 6-12 months

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

A. Directly increasing phosphocreatine stores

B. Stimulating muscle protein synthesis

C. Blocking adenosine receptors reducing fatigue perception

D. Permanently increasing resting metabolic rate

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

A. 1-4 minutes where glycolytic H^+ accumulation limits performance

B. Less than 5 seconds

C. Longer than 60 minutes

D. During complete rest

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

A. USDA Organic

B. FDA pharmaceutical approval

C. ISO 9001 manufacturing certification

D. NSF Certified for Sport or Informed Sport

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. 2.0-2.4 g/kg/day

C. Less than 0.5 g/kg

D. No protein during restriction

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

A. Permanent liver damage at any dose

B. Dangerous cardiac arrhythmias

C. GI distress including nausea, bloating, and diarrhea

D. Complete energy system suppression

86. A 68 kg endurance athlete at 10 g/kg/day requires which daily carbohydrate target?

A. 680 grams

B. 68 grams

C. 340 grams

D. 1,360 grams

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

A. Excessive uncontrollable hypertrophy

B. Enhanced performance from metabolic efficiency

C. No consequences for any athletic population

D. Impaired muscle function, compromised immunity, and elevated stress fracture risk

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

A. Inhibiting all iron absorption

B. Converting Fe^{3+} to more bioavailable Fe^{2+}

C. No interaction with iron metabolism

D. Enhancing heme iron while blocking non-heme

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. Only protein with zero carbohydrate

C. 1.0-1.5 g/kg to maximize glycogen synthase activity

D. 0.1 g/kg to minimize insulin response

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

A. Complementary plant sources throughout the day

B. Plant diets cannot provide adequate protein

C. Only soy protein at every meal

D. 100 grams isolated BCAAs daily

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

A. Immediate emptying identical to whey

B. Complete catabolic hormone suppression for 48 hours

C. No benefit because pre-sleep protein is wasted

D. Slow gel-forming digestion providing sustained amino acid delivery

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

A. Only at breakfast regardless of training schedule

B. During and immediately after exercise

C. Exclusively before sleep

D. Never by any athlete

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. Permanently elevates testosterone at all doses

C. Limited — not classified among robust ergogenic aids

D. Only supplement approved by all anti-doping agencies

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

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

B. No physiological function

C. Exclusive phosphagen system fuel during sprinting

D. Direct Type IIx fiber hyperplasia stimulation

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

A. No fluid because drinking impairs performance

B. 4 liters at halftime in a single bolus

C. Only caffeinated beverages

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

SECTION 2 — PRACTICAL/APPLIED

125 Questions | 2.5 Hours Recommended

EXERCISE TECHNIQUE (Questions 96–140)

96. An athlete performing the back squat demonstrates excessive forward lean with the chest dropping toward the thighs. This compensation most commonly indicates weakness in which muscle group?

A. The hip flexors

B. The thoracic extensors and core stabilizers

C. The ankle dorsiflexors

D. The biceps brachii

97. During the barbell overhead press, an athlete's wrists hyperextend excessively, placing the bar behind the forearm axis. This wrist position creates which primary concern?

A. Enhanced deltoid activation from the altered pressing angle

B. Improved mechanical advantage for the triceps

C. Excessive stress on the wrist extensors and carpal structures with impaired force transmission

D. No safety or performance concern

98. A strength and conditioning specialist observes an athlete performing Romanian deadlifts with the knees fully locked out and the lumbar spine rounding at the bottom of each repetition. The correction should address which technical elements?

A. Maintain slight constant knee flexion and a neutral spine throughout the entire range of motion

B. Increase the load to strengthen the lower back under flexion

C. Lock the knees harder and increase the range of motion further

D. Switch to conventional deadlifts with the same technique errors

99. An athlete performing barbell lunges consistently demonstrates the front knee collapsing medially (valgus) during each step. This fault indicates weakness in which muscle group?

A. The hip flexors and rectus femoris

B. The ankle plantarflexors and soleus

C. The anterior deltoids and upper trapezius

D. The hip abductors and external rotators (gluteus medius)

100. During a pull-up, an athlete initiates the movement by shrugging the shoulders upward before engaging the lats. This compensation reduces the training stimulus to which primary target muscle?

A. The biceps brachii and brachioradialis

B. The latissimus dorsi

C. The upper trapezius and levator scapulae

D. The posterior deltoid

101. When teaching the hang clean to a novice, the specialist notices the athlete pulls the bar using only the arms from the hang position without any leg drive. This error eliminates the contribution of which muscle groups?

A. The biceps and forearm flexors

B. The rotator cuff and anterior deltoids

C. The hip extensors (glutes, hamstrings) through triple extension

D. The abdominal muscles and obliques

102. A novice athlete performing the back squat has been coached to descend to parallel but consistently stops 4-6 inches short. Which coaching strategy most effectively addresses this depth issue?

A. Use box squats at the appropriate depth as a tactile target and reference point

B. Add more weight to force the athlete deeper

C. Eliminate the squat from the program permanently

D. Tell the athlete to bounce out of the bottom position rapidly

103. An athlete performing barbell step-ups places excessive weight on the trailing leg at the bottom position, essentially pushing off with the rear foot. This compensation reduces the training stimulus to which leg?

A. Neither leg is affected by this compensatory pattern

B. The trailing leg receiving reduced stimulus

C. Both legs receive equally reduced stimulus

D. The lead (working) leg because the rear foot assists the concentric phase

104. When spotting the barbell front squat, the spotter should position where relative to the athlete?

A. In front of the athlete gripping the barbell directly

B. Behind the athlete, ready to assist at the torso or elbows if the lift fails

C. On one side of the barbell only

D. Spotting is unnecessary for front squats under any conditions

105. Proper breathing technique during heavy resistance exercise involves exhaling during which phase?

A. Exclusively during the eccentric lowering phase

B. Only during the rest period between repetitions

C. During the concentric (exertion) phase, or using the Valsalva during maximal efforts

D. Holding the breath throughout the entire set without exhaling

106. A strength and conditioning specialist programs trap bar deadlifts for an athlete recovering from a lumbar disc issue who has been cleared for loading. The trap bar was selected because it provides which advantage?

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

B. Greater lumbar loading for targeted spinal strengthening

C. Identical biomechanics to the conventional barbell deadlift

D. Increased grip demand strengthening the forearms specifically

107. An athlete performing dumbbell bench press allows the dumbbells to drift too wide at the bottom, with elbows flared to 90° from the torso. This position creates elevated risk of which injury?

A. Biceps tendon rupture at the elbow insertion

B. Hamstring strain from the bench leg position

C. Quadriceps tendon strain from bracing on the bench

D. Shoulder impingement and/or pectoral tendon strain

108. A strength and conditioning specialist includes single-leg RDLs in a soccer player's program. This exercise selection addresses which sport-specific demand?

A. Bilateral concentric pressing power for throw-ins

B. Unilateral hip hinge strength, hamstring resilience, and single-leg balance

C. Maximal bilateral squat strength for heading duels

D. Aerobic endurance for 90-minute match demands

109. During a barbell hip thrust, an athlete hyperextends the lumbar spine at the top position, arching the lower back excessively beyond neutral. This error creates which concern?

A. Enhanced glute activation from the extended range of motion

B. Improved core stability from the arched position

C. Lumbar compressive forces and potential disc stress from end-range hyperextension under load

D. No safety concern because spinal position is irrelevant during hip thrusts

110. A strength and conditioning specialist programs tempo squats (4-second eccentric, 2-second pause, 2-second concentric) for an athlete. Tempo prescriptions primarily target which training adaptation?

A. Time under tension for hypertrophy and eccentric strength development

B. Maximum power output through high-velocity execution

C. Aerobic endurance through prolonged set duration

D. Flexibility improvement through loaded stretching

111. An athlete performing a lat pulldown pulls the bar behind the neck. This position places the shoulder in which compromised alignment?

A. Optimal biomechanical position for lat activation

B. Reduced stress on all shoulder structures

C. Protected position with minimal impingement risk

D. Extreme external rotation and horizontal abduction increasing impingement and rotator cuff injury risk

112. A strength and conditioning specialist includes Turkish get-ups in an athlete's program. This exercise primarily develops which combination of qualities?

A. Maximal bilateral pressing strength at heavy loads

B. Shoulder stability, core strength, and total-body coordination through multiple movement planes

C. Isolated biceps hypertrophy and grip endurance

D. Maximum sprint speed and acceleration mechanics

113. During a barbell hip hinge pattern, an athlete consistently rounds the thoracic spine. The specialist provides which coaching cue?

A. Flex the thoracic spine further for added stretch

B. Round the lumbar spine to match the thoracic position

C. "Chest up, shoulder blades together" to promote thoracic extension and scapular retraction

D. Look straight down at the floor throughout the movement

114. A strength and conditioning specialist programs landmine presses for an athlete with limited overhead mobility who cannot safely perform full overhead pressing. The landmine press provides which biomechanical advantage?

A. An angled pressing path that trains the pressing pattern without requiring full overhead ROM

B. Identical overhead demands to the barbell strict press

C. Exclusive lower body loading with no upper body involvement

D. Isolation of the rotator cuff without deltoid activation

115. Kettlebell swings performed correctly are classified as a hip hinge movement. The force production for the swing should originate primarily from which muscle groups?

A. The arms and anterior deltoids through shoulder flexion

B. The quadriceps through knee extension in a squatting pattern

C. The lumbar erectors through spinal extension and hyperextension

D. The hip extensors (glutes and hamstrings) through explosive hip extension

116. Cable woodchops train the core in which primary movement plane?

A. Sagittal plane through trunk flexion and extension

B. Transverse plane through rotational power production

C. Frontal plane through lateral trunk flexion

D. No specific plane because woodchops are an isolation exercise

117. An athlete demonstrates excessive lumbar movement during cable anti-rotation holds (Pallof press). This indicates insufficient strength in which core function?

A. Anti-flexion resisting sagittal plane extension

B. Anti-lateral flexion resisting frontal plane movement

C. Anti-rotation resisting transverse plane forces

D. Trunk flexion strength for sit-up performance

118. During sprint mechanics drills, an athlete demonstrates excessive backside mechanics — the foot spending too much time behind the body after ground contact. This fault reduces sprint efficiency because of which biomechanical consequence?

A. Delayed recovery of the swing leg, increasing ground contact time and reducing stride frequency

B. Enhanced horizontal force production from the extended position

C. Improved energy storage in the hamstring tendons

D. No effect on sprint performance or mechanics

119. A strength and conditioning specialist programs band-resisted sprints for an athlete. The primary training effect of the band resistance is which of the following?

A. Increased aerobic demand during the sprint effort

B. Reduced impact forces on the lower extremity joints

C. Improved flexibility of the hip flexors during sprinting

D. Overloaded horizontal force production during the acceleration phase

120. Proper landing mechanics from a box jump require which combination of technical standards?

A. Stiff-legged landing with locked knees to maximize ground stiffness

B. Soft landing with hip and knee flexion, neutral spine, and knees tracking over toes

C. Landing on the heels with the trunk flexed forward

D. Single-leg landing with the opposite leg extended behind

121. A strength and conditioning specialist includes sled pushes in a football lineman's program. This exercise primarily develops which sport-specific quality?

A. Overhead pressing strength for pass blocking

B. Vertical jumping power for jump ball situations

C. Horizontal force production and acceleration mechanics matching blocking demands

D. Aerobic endurance for sustained moderate-intensity play

122. During a barbell back squat, an athlete's knees consistently shift forward past the toes excessively. While some forward knee travel is normal, excessive travel increases stress on which structure?

A. The patellofemoral joint and patellar tendon

B. The lateral collateral ligament exclusively

C. The posterior cruciate ligament exclusively

D. The Achilles tendon exclusively

123. A strength and conditioning specialist programs eccentric-only Nordic hamstring curls for a sprinter. This exercise is specifically prescribed to reduce the risk of which injury?

A. Anterior cruciate ligament tear during cutting

B. Rotator cuff impingement during arm swing

C. Lumbar disc herniation during acceleration

D. Hamstring strain during the late swing phase of sprinting

124. When teaching proper deadlift technique, the specialist cues the athlete to "push the floor away" during the initial pull. This cue is designed to promote which movement pattern?

A. Pulling with the arms to initiate barbell movement

B. Leg drive through the floor generating force through the lower extremity before the hips extend

C. Rounded spinal flexion during the initial lift-off

D. Shoulder elevation (shrugging) as the primary force generator

125. A strength and conditioning specialist selects Bulgarian split squats over bilateral back squats for a tennis player. This exercise selection prioritizes which sport-specific benefit?

A. Maximum bilateral strength for serving power

B. Aerobic conditioning for match endurance

C. Unilateral strength, balance, and stability matching single-leg athletic demands

D. Overhead mobility for the serving motion

126. A strength and conditioning specialist programs farmer's walks for an athlete. This loaded carry exercise primarily develops which combination of qualities?

A. Grip endurance, core stability, and postural strength under load

B. Maximum overhead pressing strength

C. Isolated quadriceps hypertrophy

D. Rotational power for throwing sports

127. During the jerk receiving position, the athlete must demonstrate which key technical standard?

A. A narrow split with both feet together directly under the hips

B. Arms fully bent at the elbows with the bar resting on the head

C. A flexed thoracic spine with forward head position

D. Locked-out arms with the bar directly over or slightly behind the ears and hips

128. An athlete performing dips demonstrates excessive forward lean with the shoulders traveling well in front of the hands. This position shifts the training emphasis from triceps toward which muscle?

A. The quadriceps

B. The pectoralis major

C. The posterior deltoids

D. The biceps brachii

129. A strength and conditioning specialist programs pallof press ISO holds for 10-second sets. This exercise targets which core function?

A. Maximal trunk flexion strength for sit-up performance

B. Sagittal plane anti-extension resisting lumbar hyperextension

C. Anti-rotation strength — resisting transverse plane rotational forces

D. Maximum rotational power for throwing and hitting

130. An athlete performing glute-ham raises reports excessive low back strain. The most likely cause is which technique error?

A. Excessive hip extension substituting lumbar hyperextension for hip extensor work

B. Insufficient spinal flexion during the eccentric phase

C. Too much knee flexion during the hamstring curl component

D. Inadequate ankle dorsiflexion during foot placement

131. A strength and conditioning specialist includes depth drops (landing only, no rebound jump) in an early-phase plyometric progression. The purpose of this exercise is which of the following?

A. Developing maximum concentric jumping power

B. Building aerobic endurance through repeated low-intensity landings

C. Developing maximum rotational power for throwing sports

D. Teaching proper eccentric landing mechanics and absorption before introducing reactive jumps

132. During a barbell front squat, an athlete uses a cross-arm grip but reports significant wrist pain. Which grip modification should be considered?

A. Switch to a full clean (front rack) grip with proper wrist and elbow position

B. Switch to behind-the-neck back squats to eliminate all wrist involvement

C. Add wrist weights to strengthen the wrists under the crossed position

D. Eliminate all squat variations permanently from the program

133. A conditioning session for a volleyball team includes court-length shuttle sprints with 30-second rest periods. This protocol primarily targets which energy system?

A. The oxidative system through sustained aerobic effort

B. The phosphagen system with complete PCr recovery

C. The glycolytic system through repeated high-intensity efforts with incomplete recovery

D. No specific energy system is developed

134. A strength and conditioning specialist programs isometric mid-thigh pulls for an athlete. This exercise is primarily used to develop which quality?

A. Peak isometric force production and rate of force development

B. Maximum flexibility through loaded static stretching

C. Aerobic endurance through sustained isometric holds

D. Maximum muscular endurance through high repetitions

135. An athlete performing cable rows demonstrates scapular protraction (shoulders rounding forward) at the end of each pulling repetition instead of retraction. This error reduces activation of which muscles?

A. The pectoralis major and anterior deltoid

B. The biceps brachii and brachialis

C. The quadriceps and hip flexors

D. The middle trapezius and rhomboids

136. A strength and conditioning specialist programs loaded carries (farmer's walks, waiter walks, suitcase carries) as a primary core training method instead of traditional crunches. This approach prioritizes which core function?

A. Maximum trunk flexion strength for sit-up testing

B. Dynamic core stability under load in upright functional positions

C. Isolated rectus abdominis hypertrophy

D. Spinal flexion range of motion improvement

137. During a barbell clean, the athlete receives the bar on the clavicles with the elbows pointing straight down. This error indicates which technique failure?

A. Successful clean technique requiring no correction

B. Excessive thoracic extension in the receiving position

C. Failure to rotate the elbows forward into the high-elbow front rack position

D. Appropriate arm position for the clean catch

138. A strength and conditioning specialist programs lateral band walks for a runner experiencing medial knee collapse during squatting. This corrective exercise targets which muscle?

A. The gluteus medius to improve hip abduction and external rotation strength

B. The rectus femoris to improve knee extension strength

C. The gastrocnemius to improve ankle plantarflexion

D. The hip flexors to improve knee drive during gait

139. Conditioning for a basketball point guard (repeated 3-5 second sprint transitions with 15-25 second rest) should use which protocol?

A. Continuous 30-minute runs at 65% HRmax

B. 400-meter repeats with 2-minute rest

C. 60-minute cycling at 50% HRmax

D. Court-length sprints with 15-25 second rest replicating the position's demands

140. A strength and conditioning specialist programs face pulls with external rotation for an athlete who performs heavy bench pressing 3 times per week. The primary purpose of this exercise is which of the following?

A. Increasing bench press 1RM through direct carryover

B. Posterior shoulder and scapular health to balance pressing-dominant programming

C. Maximum pectoral hypertrophy from the pulling motion

D. Aerobic endurance for the shoulder girdle musculature

PROGRAM DESIGN (Questions 141–184)

141. A competitive 400-meter sprinter (race lasting ~48-55 seconds at near-maximal effort) relies most heavily on which energy system?

A. Exclusively the phosphagen system

B. Exclusively the oxidative system through fat metabolism

C. The glycolytic system as the primary contributor

D. No specific system is dominant

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

A. Structural, explosive, involving multiple large muscle groups

B. Single-joint machine isolation at slow tempo

C. Non-structural with no spinal loading

D. Identical to a slow curl and press combination

143. A novice athlete completing 8 weeks of training should use which testing approach to estimate 1RM?

A. Direct 1RM testing with experienced spotters on primary lifts

B. No testing of any kind for the first 2 years

C. Maximum-effort testing on day one before any training begins

D. Submaximal prediction using a 5-8 RM with validated equations

144. For an advanced athlete with 6+ years of training, which training split is most appropriate to provide sufficient volume per muscle group?

A. Total-body training 2 times per week

B. An upper/lower or push/pull/legs split allowing greater volume per session

C. One session per month at maximal loads

D. Machine-only circuit training at 30% 1RM daily

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

A. Maximal strength through neural adaptation

B. Power through high-velocity ballistic movement

C. Muscle hypertrophy through mechanical tension and metabolic stress

D. Aerobic endurance through sustained heart rate elevation

146. An athlete's tested 1RM on the deadlift is 200 kg. A strength protocol prescribes 5×3 at 87% 1RM. The working load is approximately which value?

A. 174 kg (200 × 0.87)

B. 200 kg (full 1RM for all working sets)

C. 100 kg (50% of 1RM for safety)

D. 250 kg (1RM plus 25%)

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

A. All muscle actions produce identical force

B. Eccentric training has no unique adaptive benefits

C. Concentric-only training is always superior

D. Each contraction type produces distinct neural and structural adaptations that transfer to explosive performance

148. A strength and conditioning specialist designs a weekly plan for a sprinter: Day 1 = heavy squats/pulls, Day 2 = plyometrics and sprint technique, Day 3 = rest, Day 4 = Olympic lifts and upper body, Day 5 = speed work. This separation of heavy strength and speed work on different days reflects which programming principle?

A. Daily undulating periodization varying rep ranges

B. Conjugate sequencing to avoid conflicting neural demands within a single session

C. Block periodization concentrating on one quality per block

D. Linear periodization with progressive intensity across weeks

149. Cluster sets — performing a set of 5 reps as 5 singles with 15-20 seconds rest between each rep — maintain bar velocity and power output compared to traditional straight sets because of which mechanism?

A. Complete glycogen resynthesis between each repetition

B. Full hormonal recovery between each repetition

C. Brief intra-set rest allowing partial PCr recovery and neural restoration between reps

D. Increased time under tension identical to traditional sets

150. A strength and conditioning specialist prescribes contrast training: a heavy back squat at 85% 1RM followed 3-4 minutes later by a set of jump squats at bodyweight. The rationale for this pairing is which phenomenon?

A. Post-activation potentiation (PAP) — the heavy load primes the nervous system for enhanced power output on the subsequent explosive exercise

B. Pre-exhaustion reducing the load needed for the jump squat

C. Aerobic conditioning from the rest period between exercises

D. Flexibility improvement from the heavy squat stretch

151. A strength and conditioning specialist programs velocity-based training (VBT) using a linear position transducer. Sets are terminated when bar velocity drops below 20% of the fastest rep in the set. This approach autoregulates training by controlling which variable?

A. Heart rate response during resistance exercise

B. Flexibility changes between sets

C. Blood lactate concentration during the training session

D. Fatigue-induced velocity loss to maintain movement quality and intent

152. A needs analysis for a competitive ice hockey defenseman identifies repeated 30-45 second shifts with explosive hitting, skating, and stick work, followed by 2-3 minute bench rest. The conditioning program should use which interval structure?

A. Continuous 5-mile runs at moderate intensity

B. 30-45 second high-intensity intervals with 2-3 minute rest periods matching shift demands

C. Only flexibility training for 60 minutes

D. Only heavy resistance training with no conditioning

153. An athlete returning from a grade II ankle sprain has been cleared for progressive loading. The reconditioning program should include which balance and proprioception component?

A. No balance training because it has no relevance to ankle rehabilitation

B. Only bilateral standing on stable surfaces

C. Progressive single-leg balance challenges on increasingly unstable surfaces

D. Maximal-load bilateral exercises only

154. A strength and conditioning specialist is programming for a high school basketball team with a 26-game competitive season spanning 14 weeks. The in-season program should follow which guideline?

A. 2 sessions per week with reduced volume but maintained intensity on key compound lifts

B. Complete cessation of all resistance training during the season

C. 6 sessions per week at preparatory-period volume and intensity

D. Only stretching and light bodyweight exercises

155. A strength and conditioning specialist designs a concurrent training program for an athlete who must develop both maximal strength and aerobic endurance simultaneously. Research on the interference effect suggests which programming strategy minimizes interference?

A. Perform strength and endurance in the same session with no separation

B. Only train one quality and completely ignore the other

C. Never perform endurance training under any circumstances

D. Separate strength and endurance sessions by at least 6-8 hours, prioritize strength before endurance when in the same day

156. A needs analysis for a competitive wrestler identifies that matches consist of three 2-minute periods with brief rest. The conditioning protocol should target which energy system?

A. Only the phosphagen system with 5-second sprints

B. The glycolytic system with 2-minute high-intensity intervals matching period duration

C. Only the oxidative system with continuous 30-minute runs

D. No conditioning is needed for wrestling

157. A strength and conditioning specialist programs complex training (heavy strength set paired with biomechanically similar explosive exercise) for a volleyball player: heavy back squats followed by vertical jump sets. The optimal rest between the heavy set and the explosive set for PAP is approximately which duration?

A. Zero rest — perform immediately after the heavy set

B. 30 seconds

C. 3-5 minutes allowing neural potentiation while avoiding residual fatigue

D. 20 minutes

158. An athlete's training plan includes a taper before a major competition. The typical evidence-based taper involves which combination of adjustments?

A. Reducing volume by 40-60% while maintaining or slightly increasing intensity over 1-3 weeks

B. Increasing volume by 50% and decreasing intensity

C. Maintaining full volume and adding additional sessions

D. Complete cessation of all training for 4 weeks

159. A strength and conditioning specialist programs French contrast training: heavy squat → plyometric jump → weighted jump → acceleration sprint, all performed sequentially. This advanced method targets which quality through PAP?

A. Maximal aerobic endurance over 30+ minutes

B. Flexibility improvement through loaded stretching

C. Isolated single-joint muscular endurance

D. The full force-velocity spectrum from maximal strength through speed

160. A strength and conditioning specialist programs the annual plan for a single-sport athlete competing in a fall championship. The general preparation phase should begin at which time?

A. The week before the championship

B. In late spring/early summer to allow sufficient preparation time

C. During the competitive season itself

D. 18 months after the championship has already concluded

161. A strength and conditioning specialist uses the force-velocity profile concept to identify that an athlete is "force-deficient" (strong velocity, weak force). The primary programming emphasis should be which of the following?

A. Only light-load high-velocity training

B. Only aerobic endurance training

C. Heavy resistance training (85%+ 1RM) to develop the force deficit

D. Only flexibility training

162. A strength and conditioning specialist programs a returning injured athlete through a 4-phase reconditioning progression: Phase 1 = ROM/activation, Phase 2 = strength/hypertrophy, Phase 3 = power/speed, Phase 4 = sport-specific integration. This progression reflects which rehabilitation principle?

A. Systematic rebuilding from tissue healing through functional restoration to sport-specific readiness

B. Random exercise selection with no progressive structure

C. Immediate return to full sport demands from day one

D. Permanent restriction from all athletic activity

163. A strength and conditioning specialist programs ascending pyramid loading: Set 1 = 10@70%, Set 2 = 8@75%, Set 3 = 6@80%, Set 4 = 4@85%. This loading structure targets which training outcome across the set progression?

A. Only muscular endurance at the same load throughout

B. Only flexibility through progressively heavier loaded stretching

C. Only aerobic conditioning through sustained elevated HR

D. Transitioning from hypertrophy-range stimulus to strength-range stimulus within a single session

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

A. Progressive fatigue reducing performance across waves

B. Post-activation potentiation — heavier loads in each wave prime the nervous system for subsequent sets

C. Aerobic conditioning through the extended session duration

D. Flexibility improvement from the inter-set rest periods

165. A strength and conditioning specialist identifies that an athlete has excessive bilateral strength asymmetry: right leg single-leg squat is 35% stronger than left. Which programming priority should be implemented?

A. Only bilateral exercises to mask the asymmetry

B. Ignoring asymmetry because it has no injury implications

C. Unilateral emphasis with the weaker leg performing extra volume to reduce the imbalance

D. Training only the stronger leg to maintain its advantage

166. A strength and conditioning specialist programs resisted sled sprints for acceleration development and unresisted sprint work for maximum velocity. This approach addresses which components of sprint performance?

A. Both acceleration (requiring high horizontal force) and max velocity (requiring vertical force and limb speed)

B. Only aerobic endurance for distance running

C. Only flexibility for stride length improvement

D. Only upper body strength for arm drive

167. A strength and conditioning specialist programs a deload week after every 3 loading weeks. During the deload, volume is reduced 40-50% while intensity is maintained at training-week levels. This deload structure manages which training variable?

A. Only flexibility through reduced stretching volume

B. Only nutrition through reduced caloric intake

C. Only sleep through earlier bedtimes

D. Accumulated fatigue while preserving neural and muscular stimulus

168. A strength and conditioning specialist programs descending sets (drop sets): 8@80%, immediately reduce to 65% and perform reps to near-failure. This technique targets which adaptation through which mechanism?

A. Maximal strength through heavy neural loading

B. Hypertrophy through extended mechanical tension and metabolic stress beyond initial failure

C. Power through high-velocity ballistic movement

D. Aerobic endurance through sustained moderate effort

169. An annual plan for a two-sport athlete (fall football, spring track) must accommodate two competitive seasons. The programming should follow which approach?

A. Identical maximal-volume training year-round without variation

B. Only one sport's demands addressed with the other ignored

C. Two complete preparatory → competitive → transition cycles per year (double periodization)

D. No training for either sport

170. A strength and conditioning specialist identifies that a female soccer player has a significant quadriceps-to-hamstring strength imbalance (quadriceps dominant). This imbalance increases the risk of which injury?

A. ACL injury during deceleration and cutting due to insufficient hamstring co-contraction

B. Shoulder impingement during heading

C. Wrist fracture during fall recovery

D. Lumbar disc herniation during running

171. A strength and conditioning specialist programs plyometric push-ups for an athlete. These qualify as upper body plyometrics because they require which characteristic?

A. Slow controlled tempo for maximum time under tension

B. Heavy external loading for absolute strength

C. 5-second isometric pause between lowering and pushing

D. Rapid eccentric-to-concentric transition exploiting the SSC

172. For an athlete who trains 4 days per week, an upper/lower split organized as Mon-Upper, Tue-Lower, Thu-Upper, Fri-Lower provides which advantage over a total-body approach?

A. Identical volume per muscle group with no difference

B. Greater volume per muscle group per session with 72+ hours between sessions for the same muscle groups

C. Less recovery time between same-muscle-group sessions

D. Reduced total training frequency

173. A strength and conditioning specialist programs hang clean high pulls (pulling to sternum height without catching) for an athlete who cannot safely receive the bar in the front rack position due to a wrist injury. This exercise modification preserves which training benefit?

A. Developing the front rack receiving position

B. Aerobic conditioning through sustained pulling efforts

C. Explosive triple extension and pulling power without the front rack demand

D. Flexibility development for the wrist and forearm

174. A strength and conditioning specialist programs agility ladder drills for a team during warmup. These drills primarily develop which quality?

A. Foot speed, coordination, and neuromuscular activation for warmup purposes

B. True reactive agility with perceptual-cognitive decision making

C. Maximum sprint speed for game situations

D. Maximal lower body strength for jumping

175. A strength and conditioning specialist programs the Wingate test to assess an athlete's anaerobic power and capacity. The standard test protocol uses which duration?

A. 5 seconds for peak power only

B. 60 seconds for aerobic capacity

C. 120 seconds for mixed aerobic-anaerobic assessment

D. 30 seconds of maximal-effort cycling against standardized resistance

176. A strength and conditioning specialist programs heavy sled pulls for an athlete preparing for a strongman competition. Heavy sled pulls with slow movement primarily develop which quality?

A. Aerobic endurance at low intensity

B. Maximal horizontal force production and starting strength

C. Flexibility through loaded eccentric stretching

D. Power through high-velocity movement

177. A strength and conditioning specialist programs a training session: power cleans, back squats, bench press, barbell rows, barbell curls, front planks. According to NSCA exercise order guidelines, which exercise should be placed last?

A. Power cleans

B. Back squats

C. Front planks (core/single-joint exercise performed after all multi-joint movements)

D. Bench press

178. A strength and conditioning specialist prescribes 3×20 at 55% 1RM with 30-second rest. This protocol targets which adaptation?

A. Muscular endurance through high reps, low load, and minimal rest

B. Maximal strength through neural adaptation

C. Peak power through ballistic high-velocity movement

D. Maximum hypertrophy through heavy mechanical tension

179. An annual plan for a track sprinter competing in outdoor nationals in late June should position the specific preparation phase at approximately which time?

A. January-February (too early, overlapping with general prep)

B. July-August (after the championship has already occurred)

C. November-December of the following year

D. March through May, transitioning from general preparation into competition readiness

180. A strength and conditioning specialist programs band-assisted pull-ups for an athlete who cannot perform unassisted pull-ups. This regression provides which benefit?

A. Identical loading to unassisted pull-ups with no modification

B. Reduced bodyweight resistance through the movement while maintaining the full ROM pulling pattern

C. Isolated biceps training without lat involvement

D. Maximum eccentric overload beyond bodyweight

181. A strength and conditioning specialist programs reactive agility drills where athletes respond to visual cues (coach pointing direction) while sprinting. This drill develops which quality that preplanned COD drills do not?

A. Straight-line sprint speed without direction changes

B. Only aerobic endurance for match conditioning

C. Perceptual-cognitive processing combined with physical direction change — true agility

D. Only bilateral lower body strength for decelerating

182. A strength and conditioning specialist programs a training session for a rugby forward that includes tire flips, farmer's walks, and sled drags. This strongman-style training develops which combination of qualities?

A. Total-body strength, power, grip endurance, and anaerobic work capacity

B. Only isolated upper body hypertrophy

C. Only aerobic endurance for sustained play

D. Only flexibility for contact situations

183. A strength and conditioning specialist programs hang snatches instead of full snatches from the floor for a field sport athlete. This modification is selected because it provides which advantage?

A. Identical technical demand to the full snatch from the floor

B. Greater loading potential than the floor variation

C. Eliminates the first pull from the floor which has highest technique demands

D. Reduced explosive component requiring slower bar speed

184. A strength and conditioning specialist is selecting between conventional deadlifts and sumo deadlifts for an athlete with long femurs relative to torso length. The sumo stance provides which biomechanical advantage for this body type?

A. Greater lumbar flexion demand for spinal strengthening

B. A more upright torso position reducing the moment arm on the lumbar spine

C. Identical torso position to the conventional stance

D. Increased hamstring demand compared to conventional

TESTING AND EVALUATION (Questions 185–206)

185. A strength and conditioning specialist needs to assess agility (with reactive component) in 40 athletes during a 90-minute session. Which test is most appropriate?

A. The T-test measuring preplanned directional changes

B. The pro agility shuttle with predetermined movement pattern

C. A reactive agility test where athletes respond to visual or auditory cues while changing direction

D. The 40-yard dash in a straight line

186. A strength and conditioning specialist conducts body composition testing using skinfold calipers. For the results to be reliable, the same technician should perform all measurements because of which factor?

A. Inter-tester variability in skinfold site selection and compression technique

B. Caliper calibration changes with each different user

C. Atmospheric pressure affects results based on who holds the calipers

D. Each tester creates different skin temperature affecting readings

187. An athlete's 1RM back squat is 175 kg. Using a validated prediction equation, a 5RM test yielding 150 kg predicts approximately which 1RM?

A. 150 kg (the 5RM value itself)

B. 120 kg (below the 5RM value)

C. 300 kg (double the 5RM value)

D. Approximately 169-175 kg based on standard 5RM-to-1RM prediction ratios

188. A strength and conditioning specialist assesses hamstring flexibility using the active knee extension test (AKE) rather than the sit-and-reach. The AKE provides which advantage?

A. Measures whole-body flexibility in one test

B. Isolated hamstring assessment without influence of lumbar mobility or limb proportions

C. Measures only lower back flexibility

D. Requires expensive laboratory equipment

189. A pre-participation health screening reveals that an athlete has a family history of sudden cardiac death, experiences exertional chest pain, and has exercise-induced syncope. The specialist should do which of the following?

A. Begin training immediately with no restrictions

B. Reduce training intensity to 50% and monitor symptoms

C. Require physician clearance before any exercise participation

D. Ignore the screening results because the athlete appears healthy

190. A strength and conditioning specialist measures vertical jump using a force plate and a Vertec jump-and-reach device. The force plate provides which additional data that the Vertec cannot?

A. Peak GRF, RFD, impulse, and power output in addition to jump height

B. Only jump height identical to the Vertec measurement

C. Only the athlete's body weight before the jump

D. Only flight time from takeoff to landing

191. The Yo-Yo Intermittent Recovery Test is specifically designed for which sport type and what does it assess?

A. Continuous endurance sports measuring steady-state VO_2max

B. Strength sports measuring maximal force production

C. Power sports measuring vertical jump height

D. Intermittent team sports assessing repeated high-intensity exercise capacity with recovery

192. A strength and conditioning specialist conducts the 1RM test for the back squat. The athlete completes 165 kg with acceptable depth and technique, then fails at 170 kg with the hips rising faster than the chest (good morning pattern). The recorded 1RM is which value?

A. 170 kg because the athlete attempted this weight

B. 165 kg — the last successful lift with acceptable technique

C. 167.5 kg as the average of success and failure

D. The test is invalid and must restart completely

193. An athlete's baseline testing reveals: vertical jump = 45th percentile, 20-yard sprint = 40th percentile, pro agility = 52nd percentile, 1.5-mile run = 72nd percentile, bench press = 80th percentile, squat = 78th percentile. The testing profile reveals which primary deficiency area?

A. Upper body strength at the 80th percentile

B. Lower body strength at the 78th percentile

C. Speed, power, and agility (all below 55th) relative to well-developed strength and endurance

D. Aerobic endurance at the 72nd percentile

194. A strength and conditioning specialist performs the functional movement screen (FMS) on an incoming freshman. The athlete scores a 1 (pain) on the deep squat. The appropriate response is which of the following?

A. Referral for medical evaluation because pain during screening indicates possible pathology requiring clinical assessment

B. Heavy squat loading to strengthen through the painful range

C. Ignoring the pain score because the FMS is not clinically relevant

D. Immediately beginning a plyometric program to build tolerance

195. A strength and conditioning specialist uses the 300-yard shuttle to assess an athlete's anaerobic capacity. The test involves 12 × 25-yard shuttles performed maximally with total time recorded. This test is classified as which type?

A. An aerobic capacity measure predicting VO_2max

B. A flexibility assessment for lower body mobility

C. A maximal strength test predicting 1RM

D. An anaerobic capacity field test measuring glycolytic performance

196. A strength and conditioning specialist assesses upper body muscular endurance using the push-up test. For male athletes, which performance standard classifies as "excellent" according to most normative tables?

A. 5-10 repetitions

B. 50+ repetitions for young adult males according to most normative references

C. 15-20 repetitions

D. 1 repetition maximum

197. A strength and conditioning specialist tracks an athlete's training response using the reactive strength index (RSI) calculated from a depth jump: jump height divided by ground contact time. An improving RSI over time indicates which adaptation?

A. Declining aerobic capacity

B. Reduced flexibility

C. Enhanced reactive strength — greater jump height with equal or shorter contact time

D. Decreased eccentric strength

198. A strength and conditioning specialist uses the Wingate test to assess anaerobic power. Peak power occurs within the first few seconds and represents which energy system?

A. The phosphagen system providing the highest instantaneous power output

B. The oxidative system at peak aerobic contribution

C. The glycolytic system at maximum lactate production

D. Equal contribution from all three systems simultaneously

199. A strength and conditioning specialist performs a bilateral comparison using single-leg countermovement jumps. The right leg jumps 28 cm and the left jumps 22 cm. The asymmetry index is approximately which value?

A. Approximately 21% asymmetry ([28-22]/28 × 100), exceeding the 10-15% threshold

B. Less than 5% asymmetry within normal limits

C. Exactly 0% because both legs produced a measurable jump

D. Approximately 50% asymmetry

200. A strength and conditioning specialist selects the hexagonal bar jump test over the countermovement vertical jump for a football lineman. This test was selected because it provides which advantage for this specific population?

A. Only measures aerobic capacity

B. Evaluates lower body power with external load in a movement pattern resembling the athletic stance

C. Eliminates all lower body involvement

D. Measures only upper body strength

201. A strength and conditioning specialist programs repeated sprint ability (RSA) testing: 6 × 30-meter sprints on 30-second intervals. This test specifically measures which capacity?

A. Maximal single-sprint speed only

B. Aerobic steady-state endurance

C. The ability to maintain sprint performance across repeated efforts with incomplete recovery

D. Maximal strength for a single repetition

202. A strength and conditioning specialist calculates the eccentric utilization ratio (EUR): CMJ height ÷ SJ height. An EUR of 1.05 versus 1.25 in two athletes of equal SJ height indicates what about the first athlete?

A. The first athlete has superior SSC utilization

B. Superior aerobic capacity in the first athlete

C. Equal SSC utilization between both athletes

D. Poorer SSC utilization — the first athlete derives less additional performance from the countermovement

203. An athlete's VJ power can be estimated using the Lewis formula or the Sayers equation. Both formulas require which two variables?

A. Only body weight

B. Only jump height

C. Body weight and jump height

D. Body weight and jump height plus arm length

204. A strength and conditioning specialist selects the medicine ball power throw test over the bench press 1RM for assessing upper body power in a basketball player. This selection is based on which rationale?

A. The med ball throw measures upper body strength better than the bench press

B. The med ball throw assesses explosive power through velocity of release rather than maximal force at slow speeds

C. The bench press is more sport-specific for basketball

D. The med ball throw measures aerobic endurance

205. A strength and conditioning specialist programs a battery of tests for a collegiate baseball team in the following order: vertical jump, pro agility, 60-yard sprint, bench press, squat. This test order follows which principle?

A. Random sequence with no specific ordering rationale

B. Strength tests should always precede speed and power tests

C. Agility and speed tests first, followed by strength tests to prevent fatigue from affecting time/power measures

D. All tests should be performed in alphabetical order

206. A strength and conditioning specialist interprets an athlete's test results across two testing sessions separated by 12 weeks. For a change to be considered meaningful, it must exceed which statistical threshold?

A. The minimal detectable change (MDC) or smallest worthwhile change (SWC) specific to each test

B. Any numerical change, regardless of magnitude

C. At least a 50% improvement on every test

D. Only changes visible to the naked eye during testing

ORGANIZATION AND ADMINISTRATION (Questions 207–220)

207. A university strength and conditioning facility operates from 6 AM to 9 PM. During peak hours (3-6 PM), 65 athletes train simultaneously. Using the NSCA's upper guideline of 60 sq ft per athlete, the minimum recommended training area for peak capacity is which of the following?

A. 650 sq ft

B. 1,300 sq ft

C. 6,500 sq ft

D. 3,900 sq ft (65 × 60)

208. An emergency action plan should specify which of the following elements?

A. Only the location of the nearest hospital

B. Personnel roles, communication procedures, equipment locations, emergency contact numbers, facility access routes for EMS, and regular rehearsal schedules

C. Only the head coach's cell phone number

D. Only the nearest fire exit location

209. A strength and conditioning specialist discovers that the facility's AED has an expired battery that was due for replacement 4 months ago. The appropriate response is which of the following?

A. Continue using the AED because expired batteries usually work

B. Ignore the expiration because AEDs are rarely needed

C. Replace the battery immediately and document the maintenance action

D. Remove the AED from the facility permanently

210. An athlete discloses a sickle cell trait diagnosis. The strength and conditioning specialist should implement which specific precautions?

A. Gradual acclimatization, adequate hydration, modified high-intensity intervals at altitude or in heat, and awareness of exertional sickling warning signs

B. No modifications because sickle cell trait has no exercise implications

C. Complete permanent restriction from all physical activity

D. Only upper body exercises with no cardiovascular conditioning

211. A high school strength and conditioning specialist operates without any other qualified staff. When 35 athletes are training simultaneously, the specialist must perform which supervisory action?

A. Leave the facility to take a personal break

B. Allow athletes to spot themselves on all exercises

C. Operate only peer-supervised stations without professional oversight

D. Maintain visual contact with all training areas and restrict exercise selection to movements safe for the supervision ratio

212. Professional liability insurance for a CSCS-credentialed professional provides protection against which type of claim?

A. Only property damage to facility equipment

B. Negligence claims alleging that professional services caused injury or harm to an athlete

C. Only workers' compensation for the specialist's own injuries

D. Only contract disputes with facility management

213. A strength and conditioning specialist receives a request from a sport coach to implement a "punishment workout" (excessive exercise volume as discipline for losing a game). According to professional standards, the appropriate response is which of the following?

A. Comply because the sport coach has authority over disciplinary decisions

B. Implement the workout but document personal concerns privately

C. Decline because punishment workouts violate professional standards and expose athletes to injury risk from excessive, unplanned training volume

D. Post about the situation on social media

214. A facility's written policies should include which of the following documents?

A. Emergency action plan, equipment inspection protocols, supervision ratios, athlete conduct standards, and injury reporting procedures

B. Only the building lease agreement

C. Only the Wi-Fi password for the facility

D. Only the staff break schedule

215. A strength and conditioning specialist identifies that a piece of cable equipment has a frayed cable showing exposed wire strands. The equipment is still functional but the fraying is progressing. The correct response is which of the following?

A. Continue use until the cable breaks completely

B. Apply tape over the frayed section and continue use

C. Allow athletes to use it with a verbal warning about the damage

D. Immediately remove from service, tag out of order, document, and arrange repair/replacement

216. An athlete arrives at the facility wearing headphones and begins training without checking in or warming up. The specialist should do which of the following?

A. Ignore the behavior because personal warmup is optional

B. Require the athlete to complete the standard check-in process and prescribed warmup before beginning loaded exercises

C. Allow the athlete to train unsupervised in isolation

D. Immediately dismiss the athlete from the program permanently

217. A minor athlete's parent submits a medical clearance form signed by a chiropractor rather than an MD, DO, or NP. According to facility policy requiring physician clearance, the specialist should do which of the following?

A. Accept the form because any healthcare provider signature is equivalent

B. Begin training immediately without any clearance documentation

C. Require a clearance form signed by a physician (MD/DO) or qualified provider meeting facility policy requirements

D. Permanently deny the minor access to the facility

218. A strength and conditioning specialist observes an intern giving an athlete contradictory spotting instructions (e.g., "grab the bar if they fail" during a back squat). The specialist should do which of the following?

A. Immediately correct the instruction, demonstrate proper spotting technique, and provide direct supervision of the intern

B. Ignore the situation because interns learn through mistakes

C. Allow the athlete to continue with incorrect spotting

D. Dismiss the intern from the program permanently without coaching

219. A facility's insurance policy requires a minimum supervision ratio of 1:20 (one qualified professional per 20 athletes). During a training session, 42 athletes are present with only one specialist. The appropriate response is which of the following?

A. Continue training all 42 athletes without modification

B. Ignore the insurance requirement because it is not legally binding

C. Allow athletes to self-supervise in groups

D. Restrict the session to 20 athletes or arrange for additional qualified supervision before continuing

220. A strength and conditioning specialist is designing the annual budget for a collegiate facility. Which expenditure category should receive highest priority?

A. Decorative facility upgrades and aesthetic improvements

B. Equipment maintenance, safety equipment (AED/first aid), and staff professional development

C. Marketing materials and social media content creation

D. Entertainment systems and music licensing for the training floor

PRACTICE EXAM 11 — ANSWER KEY WITH EXPLANATIONS

SECTION 1 — SCIENTIFIC FOUNDATIONS

EXERCISE SCIENCE (Questions 1–52)

1. C — The most consistently documented fiber type transition from chronic training is the conversion of Type IIx fibers to the more oxidative, fatigue-resistant Type IIa phenotype within the Type II fiber spectrum. This shift occurs because regular contractile activity stimulates the expression of Type IIa myosin heavy chain isoforms while downregulating the Type IIx isoform. The Type IIa fibers retain fast-twitch characteristics while gaining improved oxidative capacity and fatigue resistance.

2. A — The I-band represents the region where only thin (actin) filaments are present without overlap from thick (myosin) filaments. As the actin filaments slide inward toward the M-line during contraction, this non-overlap zone narrows progressively. The A-band remains constant because the myosin filaments themselves do not shorten — only the relative sliding position of actin over myosin changes during the contraction cycle.

3. D — An experienced lifter with 5 years of training has already maximized most neural adaptations (motor unit recruitment, rate coding, intermuscular coordination). Further strength improvements must come primarily through the slower process of structural hypertrophy — increasing the cross-sectional area of contractile proteins. This neural-to-structural shift explains why advanced trainees show larger hypertrophy gains relative to their modest strength improvements.

4. B — Calcium released from the sarcoplasmic reticulum binds specifically to troponin C, one of the three subunits of the troponin complex located on the thin (actin) filament. This binding causes a conformational change in tropomyosin, shifting it away from the myosin binding sites on actin. The exposed binding sites then allow energized myosin heads to attach and begin the cross-bridge cycle that produces muscle force.

5. A — Average RFD = change in force ÷ change in time = 3,800 N ÷ 0.180 s = 21,111 N/s. This calculation represents the average rate at which force increased from baseline to peak during the 180-millisecond contraction window. RFD is a critical performance variable for explosive athletes because many sport movements require force production within time frames shorter than the time needed to reach peak isometric force.

6. D — 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. Type IIx motor units, with the highest activation thresholds, are the last to be recruited and require force demands approaching 80-85% or more of maximal voluntary contraction. This is why heavy loading is essential for activating the complete motor unit pool.

7. B — The GTO produces autogenic inhibition through an Ib inhibitory interneuron in the spinal cord. When the GTO detects elevated tension at the musculotendinous junction, it sends afferent signals through Ib fibers to the inhibitory interneuron, which then reduces alpha motor neuron activity to the same muscle. This protective mechanism limits force production to prevent tendon damage, and its modification through chronic heavy training is a significant neural contributor to strength gains.

8. C — The VO_2 plateau at 56 mL/kg/min despite two additional stages of increased workload, combined with an RER of 1.18 and heart rate near age-predicted maximum, confirms VO_2max. The primary criterion (plateau in VO_2 despite increasing demand) is validated by secondary criteria, confirming the athlete has reached the absolute ceiling of the cardiovascular system's capacity to deliver and the muscles' capacity to consume oxygen.

9. A — A 30-second maximal cycling effort falls within the glycolytic-dominant duration range. 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 enzymatic function and cross-bridge cycling — producing the severe burning, 15 mmol/L lactate, and progressive power decline observed.

10. D — The progressive RER decrease from 0.87 to 0.77 over 3.5 hours reflects a gradual metabolic shift from carbohydrate toward greater fat oxidation as glycogen stores deplete during prolonged moderate-intensity exercise. As intramuscular and hepatic glycogen becomes less available, the body relies increasingly on the slower but more abundant fat oxidation pathways, producing the lower CO_2-to-O_2 ratio characteristic of fat metabolism.

11. B — The Krebs cycle (citric acid cycle) occurs in the mitochondrial matrix, where acetyl-CoA derived from pyruvate, fatty acids, and amino acids is oxidized through a series of enzymatic reactions. The cycle produces NADH, $FADH_2$, a small amount of ATP/GTP, and CO_2. The NADH and $FADH_2$ then deliver their electrons to the electron transport chain on the inner mitochondrial membrane for the production of the majority of aerobic ATP.

12. C — Despite yielding approximately 129 ATP per palmitate molecule versus 36-38 from glucose, fat oxidation through beta-oxidation produces ATP at a rate far too slow to match the rapid energy demands of high-intensity exercise. The rate limitation — not total yield — determines which substrate dominates at any given intensity. When energy demand is high, the body must rely on the faster carbohydrate pathways through glycolysis and oxidative phosphorylation.

13. A — After 4 hours at 65% VO_2max, muscle and liver glycogen stores become substantially depleted and blood glucose drops to hypoglycemic levels (46 mg/dL). Without adequate carbohydrate substrate, the body cannot maintain the rate of ATP production needed to sustain the

exercise intensity — the classic endurance "bonk." This performance decline can only be prevented or delayed through strategic carbohydrate intake during prolonged exercise.

14. D — After stroke volume plateaus at approximately 40-60% of VO_2max (limited by ventricular filling time as heart rate increases), further increases in cardiac output depend entirely on continued heart rate increases driven by progressive sympathetic nervous system activation. Heart rate rises approximately linearly with exercise intensity until approaching the age-predicted maximum, making maximal heart rate a key limiter of maximal cardiac output.

15. B — Net upward force = GRF − body weight = 3,100 − 833 = 2,267 N. Acceleration = force ÷ mass = 2,267 ÷ 85 = 26.7 m/s^2. Only the force exceeding the athlete's body weight produces upward acceleration — the first 833 N simply supports the body mass against gravity. This calculation demonstrates why producing high peak GRF relative to body weight is essential for vertical jump performance.

16. C — The biceps curl exemplifies a third-class lever where the effort (biceps insertion on the radial tuberosity) is positioned between the fulcrum (elbow joint) and the resistance (dumbbell held in the hand). Because the effort arm is much shorter than the resistance arm, the muscle must produce approximately 8 times the external load to create sufficient torque for movement. The tradeoff is that this arrangement favors speed and range of motion at the distal end.

17. A — The bicarbonate buffering system neutralizes hydrogen ions from glycolytic metabolism: $H^+ + HCO_3^- \rightarrow H_2O + CO_2$. The additional CO_2 produced by this buffering reaction stimulates chemoreceptors that trigger a disproportionate increase in ventilation for CO_2 removal. This non-linear ventilatory increase — breathing rising faster than VO_2 — defines the ventilatory threshold and closely corresponds to the lactate threshold intensity.

18. D — Contact times increasing from 170 ms to 360 ms with declining rebound height confirms fatigue and loss of SSC effectiveness. When the amortization phase exceeds approximately 250 ms, elastic energy dissipates as heat and the stretch reflex contribution diminishes. Plyometric training is quality-based — every repetition should demonstrate maximal effort with minimal contact time. Continuing trains degraded movement patterns with no power benefit.

19. B — Research on elite sprinters consistently demonstrates that the vertical ground reaction force applied during the brief 80-100 ms ground contact phase at maximum velocity is the primary factor distinguishing faster from slower runners. Faster sprinters produce greater vertical force relative to body weight, effectively "bouncing" off the ground with greater musculotendinous stiffness. This vertical force application, not horizontal pushing, drives maximum velocity performance.

20. C — Eccentric cardiac hypertrophy from chronic endurance training enlarges the left ventricular chamber, allowing greater blood filling during diastole. This larger end-diastolic volume directly increases the stroke volume — the amount of blood ejected per beat during systole. Increased maximal stroke volume is the primary cardiovascular mechanism by which endurance training enhances maximal cardiac output and therefore VO_2max.

21. A — Blood flow redistribution during maximal exercise is accomplished through two simultaneous mechanisms: local metabolic vasodilation in working muscles (mediated by increased CO_2, decreased O_2, 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 during maximal effort.

22. D — 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 between sets prevents full metabolic recovery, maintaining the acidic cellular environment that triggers GH secretion from the anterior pituitary gland. The heavy protocol with 5-minute rest minimizes metabolic stress but provides superior neural adaptation.

23. B — A progressively declining T:C ratio over 7 weeks, combined with performance stagnation, elevated resting heart rate, insomnia, and persistent fatigue, represents the classic presentation of overtraining syndrome. The chronic imbalance between accumulated training stress and recovery capacity has produced systemic hormonal maladaptation requiring significant reduction in training volume and intensity, structured recovery, and potential medical evaluation.

24. C — Female athletes achieve significant strength gains primarily through neural adaptations — improved motor unit recruitment, enhanced rate coding (firing frequency), better intermuscular coordination, and reduced antagonist co-contraction. These neural mechanisms are not testosterone-dependent and account for a larger proportion of total strength gains in females because the lower testosterone environment (10-15× less than males) limits the magnitude of structural hypertrophy.

25. A — Wolff's Law predicts that bone remodels in response to the mechanical stresses placed upon it. Ground-based resistance exercises (squats, deadlifts, weighted lunges) combined with impact activities apply large compressive and impact forces directly to the axial and appendicular skeleton. These weight-bearing, high-force activities provide the greatest osteogenic stimulus, far exceeding non-weight-bearing alternatives like aquatic exercise or cycling.

26. D — With identical 1RM values (185 kg), the 17 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. B — Torque = force × moment arm = (9 kg × 9.81 m/s²) × 0.60 m = 88.29 N × 0.60 m ≈ 53 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 gravitational

force line. This calculation demonstrates why even moderate dumbbell weights create substantial torque demands during lateral raises.

28. 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 and prevents diastolic pressure from rising during steady-state moderate-intensity exercise.

29. A — The combination of 10-month amenorrhea, grossly inadequate caloric intake (1,100 kcal with 3 hours daily training), DEXA-confirmed decreased lumbar BMD, and two recent stress fractures represents Relative Energy Deficiency in Sport (RED-S). Low energy availability is the driving factor — insufficient calories relative to exercise expenditure disrupts the hypothalamic-pituitary-ovarian axis, causing menstrual dysfunction and compromised bone health.

30. D — Cortisol's acute catabolic actions include stimulating protein degradation (breaking down amino acids from muscle protein) and gluconeogenesis (converting those amino acids into glucose in the liver). These processes mobilize amino acid substrates to produce glucose for the brain — which is obligatorily glucose-dependent — and other tissues requiring glucose during periods of metabolic stress when glycogen stores are depleting.

31. B — Enhanced androgen receptor density from chronic resistance training increases the muscle's sensitivity and responsiveness to circulating testosterone at the tissue level. Each testosterone molecule produces a stronger anabolic signal, potentially amplifying the hypertrophic and strength response to training even without changes in basal circulating hormone concentrations. This is a significant tissue-level adaptation contributing to the training response.

32. C — The crossover concept describes the intensity-dependent progressive shift from predominantly fat oxidation at low exercise intensities to predominantly carbohydrate oxidation at higher intensities. As the body requires faster rates of ATP production at increasing workloads, it progressively relies more on carbohydrate pathways that can produce ATP at a faster rate than the slower fat oxidation pathways.

33. A — The Cori cycle recycles lactate through the liver, where hepatocytes convert it back to glucose via gluconeogenesis. This recycled glucose is released into the blood for use by working muscles and the brain. The pathway is particularly important during sustained exercise because it helps maintain blood glucose levels as glycogen depletes, providing continued substrate for the obligatorily glucose-dependent brain.

34. D — 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 — the rate advantage that makes the phosphagen system dominant during the first 6-10 seconds of maximal effort.

35. B — During the contract-relax PNF technique, the 6-second isometric contraction generates high tension that activates the Golgi tendon organ at the musculotendinous junction. The GTO sends inhibitory signals through an Ib inhibitory interneuron that reduce alpha motor neuron activity to the target muscle. This autogenic inhibition temporarily decreases muscle tone and resistance to passive stretch, allowing a greater range of motion immediately following the contraction.

36. C — 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 at the cellular level. When training resumes, the additional nuclei accelerate the protein synthetic response, allowing faster recovery of muscle size and strength.

37. 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 training cessation. This hierarchy of detraining rates is critical for prioritizing which qualities to maintain during injury rehabilitation or competitive season management.

38. A — The 22-degree difference between passive ROM (140°) and active ROM (118°) 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.

39. B — 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 the muscle force alone. This is why the calf muscles can support and lift the entire body weight during plantar flexion.

40. D — Tendons and ligaments have lower metabolic activity and reduced blood supply compared to skeletal muscle tissue, resulting in slower rates of collagen synthesis, turnover, and structural remodeling. This means that connective tissues require more time to adapt to increased training loads than the muscles they support. Progressive overload must be gradual enough to allow these structures to keep pace with muscular strength gains.

41. C — During moderate-intensity exercise, pulse pressure widens because systolic blood pressure increases (from greater cardiac contractility and stroke volume) while diastolic pressure remains stable or slightly decreases (from vasodilation in working muscles reducing peripheral resistance). The net result is a wider gap between systolic and diastolic values, reflecting the cardiovascular system's response to increased oxygen delivery demands.

42. A — Stable resting testosterone with decreased cortisol produces a favorable improvement in the testosterone-to-cortisol ratio, indicating a positive anabolic-catabolic balance. Combined with continued performance gains, adequate sleep, and subjective recovery between sessions, this hormonal profile confirms successful adaptation to the training program without signs of overreaching or overtraining syndrome.

43. B — The improvement from approximately 70% to 90% voluntary activation reflects two complementary neural adaptations: reduced inhibition from the Golgi tendon organ (neural disinhibition) and improved central drive from the motor cortex to the spinal motor neuron pool. These adaptations allow the athlete to voluntarily recruit a greater percentage of the available motor unit pool, producing force closer to the structural capacity of the musculotendinous unit.

44. D — The high jump demands unilateral takeoff power from a single-leg base, rapid rate of force development during the brief ground contact at takeoff, vertical power through the stretch-shortening cycle mechanics of the approach and plant, and explosive approach run speed. Slow bilateral squats alone fail to develop any of these sport-specific qualities, violating the SAID principle's requirement for training specificity.

45. 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 maximum force end (near-zero velocity), power approaches zero despite high force. At the maximum velocity end (near-zero force), power also approaches zero despite high speed.

46. A — The pronounced forward lean during sprint acceleration allows the athlete to direct ground reaction forces primarily horizontally backward against the ground. By Newton's Third Law, the ground pushes back with an equal forward-directed reaction force that overcomes the body's inertia and generates forward momentum from a stationary or near-stationary start. Running upright would direct forces too vertically, reducing the horizontal component essential for acceleration.

47. B — The stretch reflex (myotatic reflex) is a monosynaptic reflex — involving only a single synapse between the afferent sensory neuron from the muscle spindle and the efferent alpha motor neuron. This single-synapse arrangement makes it the fastest possible reflexive contraction in the human body, occurring in milliseconds. During plyometric landing, the rapid eccentric stretch activates spindles that produce this reflex to augment concentric force.

48. D — The 12 cm difference between the CMJ (64 cm) and the SJ (52 cm) represents the contribution of the stretch-shortening cycle to concentric force production. The three SSC mechanisms — stored elastic energy in the musculotendinous unit, the stretch reflex from muscle spindle activation, and increased time for force development during the eccentric phase — augment the concentric takeoff beyond what concentric-only contraction can produce.

49. C — Both athletes produce identical peak force (3,000 N), but Athlete A reaches peak force in 135 ms versus 275 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), resulting in higher takeoff velocity and therefore greater jump height. RFD is the critical discriminator when peak force is equal.

50. A — When the amortization phase exceeds approximately 250 ms, the elastic energy stored in the musculotendinous unit during the eccentric landing dissipates as heat rather than being returned as mechanical work during the concentric takeoff. Additionally, the stretch reflex contribution from muscle spindle activation diminishes because the rapid eccentric-to-concentric transition that maximally stimulates the spindle has been disrupted by the prolonged transition delay.

51. D — Retained myonuclei from prior training persist during detraining-induced atrophy because myonuclei, once donated by satellite cells during hypertrophy, are not lost when the fiber shrinks. When training resumes, these additional nuclei accelerate the protein synthetic response, allowing faster recovery of muscle size and strength compared to individuals who never trained. This cellular mechanism explains the well-documented "muscle memory" phenomenon.

52. B — Individuals with uncontrolled hypertension or cardiovascular disease face serious risk from the extreme transient blood pressure spikes produced by the Valsalva maneuver during heavy lifting. Pressures exceeding 350/280 mmHg may exceed the structural limits of compromised blood vessels or the functional capacity of a damaged heart, potentially causing stroke, aneurysm rupture, or cardiac event. Healthy trained athletes generally tolerate these acute spikes without adverse consequence.

SPORT PSYCHOLOGY (Questions 53–75)

53. C — Muscle tension, elevated heart rate, shallow rapid breathing, and sweaty palms are somatic anxiety symptoms — the physiological activation component of competitive anxiety. Somatic anxiety represents the body's physical stress response, distinct from cognitive anxiety (negative thoughts, worry). Distinguishing between the two components is essential because each requires a different intervention strategy: physical relaxation for somatic, cognitive restructuring for cognitive.

54. A — A precision free-throw requires steady hands, visual focus, and fine motor control — all degraded by excessive arousal. According to the inverted-U hypothesis, fine motor precision tasks have a lower optimal arousal point than gross motor strength tasks. Low-to-moderate arousal preserves the fine coordination, steady muscular control, and focused attention required for consistent free-throw accuracy under competitive pressure.

55. 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 different situations and tasks. Self-efficacy is built and modified through four specific sources: mastery experience, vicarious experience, verbal persuasion, and physiological state interpretation.

56. B — "You jumped 78 cm" provides information about the outcome of the performance — the measurable result. This is knowledge of results (KR), which tells the athlete what happened but not how the movement was executed. Knowledge of performance (KP), by contrast, would describe the technique quality — such as "your arms swung too late" — providing actionable information for movement correction.

57. C — 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.

58. A — The guidance hypothesis states that providing extrinsic feedback after every single repetition creates dependency on external correction rather than forcing the athlete to develop their own internal error-detection capabilities. The athlete learns to wait for the coach's input rather than attending to proprioceptive information. Reducing feedback frequency to approximately 50% of trials forces the athlete to develop self-monitoring skills that produce more durable motor learning.

59. D — Memory consolidation during rest intervals is the neurological process of stabilizing and transferring motor memories from short-term to long-term storage. Distributed practice (shorter sessions with rest between) allows this consolidation process to occur between practice bouts, producing more durable motor program representations that resist forgetting. Massed practice does not provide sufficient inter-trial time for this neural consolidation to occur effectively.

60. B — The cognitive stage in Fitts and Posner's model is characterized by large, frequent errors and heavy reliance on verbal instruction and demonstrations from the coach. The athlete is trying to understand what the movement requires — "What am I supposed to do?" — with highly variable, inconsistent execution from trial to trial. This stage requires explicit instruction, frequent feedback, and patient repetition of fundamental movement components.

61. C — Athletic burnout is characterized by three interrelated dimensions: emotional exhaustion (feeling physically and psychologically drained by the sport), depersonalization (cynicism and emotional detachment from the sport and teammates), and reduced sense of personal accomplishment (feeling that continued effort produces no meaningful results). Burnout develops over weeks to months and requires professional intervention, distinguishing it from acute performance anxiety.

62. A — Increasing isolation, persistent feelings of worthlessness, lost interest in previously enjoyed activities, and expressed hopelessness are potential warning signs of clinical depression in an adolescent athlete. The strength and conditioning specialist must recognize these signs as beyond normal mood fluctuation and recommend that parents seek evaluation from a qualified mental health professional. Attempting to address these symptoms through training modifications alone is inappropriate.

63. D — Self-determination theory, developed by Deci and Ryan, identifies autonomy (sense of choice and control over one's actions), competence (feelings of mastery, effectiveness, and progressive improvement), and relatedness (meaningful connection to others and sense of belonging) as the three basic psychological needs supporting intrinsic motivation. When all three needs are satisfied, athletes develop the most sustainable and resilient form of internal drive.

64. B — Observing a teammate of similar ability and experience successfully complete a challenging lift provides vicarious experience — one of Bandura's four sources of self-efficacy. Seeing someone of comparable capability succeed provides evidence that the task 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.

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

66. A — 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 and treatment. Diagnosing and treating eating disorders is entirely outside the CSCS scope of practice. The specialist must refer the athlete to a qualified healthcare professional for appropriate assessment.

67. 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). Chronic low energy availability drives these consequences regardless of sex, expanding beyond the original female athlete triad concept.

68. B — Fear of re-injury after ACL reconstruction is a recognized psychological barrier to successful return to sport that requires a comprehensive, patient 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 interventions such as graded exposure and cognitive restructuring.

69. C — When a pitcher throws a fastball and then a changeup, the overall speed and absolute force of execution change (variable parameters), while the invariant features — relative timing of muscle activations, relative force proportions 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 one base movement to serve different tactical purposes.

70. A — Scanning the entire court to identify open teammates, defender positions, and spacing requires broad-external attentional focus — perceiving multiple external stimuli across a wide visual field simultaneously for tactical decision-making. This broad scanning allows the point guard to process the full defensive scheme before narrowing focus to execute a specific pass or drive as the play develops.

71. D — Past performance accomplishment is the most powerful of Bandura's four self-efficacy sources. Successfully completing 195 kg provides direct, personal, undeniable evidence of capability at this load level, creating the strongest possible confidence that 200 kg is achievable. Mastery experiences generate stronger and more resilient efficacy beliefs than observation, encouragement, or anxiety management.

72. B — Research demonstrates that reducing feedback frequency from 100% to approximately 50% of trials produces better long-term retention despite potentially slower initial acquisition. The reduced frequency forces athletes to attend to their own proprioceptive and kinesthetic information, developing internal error-detection capabilities. This self-monitoring skill produces more durable, self-sustaining motor learning that persists in the absence of external coaching.

73. C — Muscle tension, elevated heart rate, and rapid breathing are somatic anxiety symptoms — the physiological activation component of competitive anxiety. Physical relaxation techniques such as progressive muscle relaxation and diaphragmatic breathing directly target these symptoms by teaching systematic tension release and engaging the parasympathetic nervous system to reduce cardiovascular and respiratory activation.

74. 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 position. The shared movement features between these 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.

75. D — Effective mental imagery engages visual (seeing the performance), kinesthetic (feeling the muscular sensations and body positions), auditory (hearing environmental sounds), and emotional (experiencing the confidence and composure of success) components simultaneously. Multi-sensory engagement creates the richest, most vivid mental rehearsal that transfers most effectively to actual competitive performance.

NUTRITION (Questions 76–95)

76. B — A 95 kg athlete at 2.2 g/kg/day requires 209 grams of protein daily (95 × 2.2 = 209). 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 (76 grams) is insufficient for athletes engaged in intense training.

77. C — Leucine is the branched-chain amino acid identified as the primary trigger for activating the mTOR signaling pathway that initiates muscle protein synthesis. A threshold of approximately 2-3 grams of leucine per protein-containing meal ensures optimal stimulation of the protein synthetic machinery. This leucine threshold is a key consideration when evaluating protein source quality for athletic recovery and adaptation.

78. A — 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 in the Leydig cells of the testes. Additionally, fat-soluble vitamins (A, D, E, K) require dietary fat for intestinal absorption. Both consequences compromise health, recovery, and training adaptation.

79. D — Exercise-associated hyponatremia occurs when excessive plain water intake during prolonged exercise dilutes blood sodium concentration below safe levels (below 135 mmol/L). Consuming 2.5 liters per hour for 5 hours without sodium replacement dramatically reduces serum sodium relative to the sodium lost through sweat. This dangerous condition can produce confusion, disorientation, seizures, and potentially fatal cerebral edema in severe cases.

80. B — 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 — the only difference is that it takes 4 weeks instead of 1 week through gradual daily accumulation.

81. C — Caffeine's primary ergogenic mechanism is blocking adenosine receptors in the central nervous system. Adenosine is a neuromodulator that promotes drowsiness, reduces neural activity, and increases the perception of fatigue; by blocking these receptors, caffeine reduces fatigue perception, increases alertness and cognitive focus, and enhances pain tolerance during high-intensity effort.

82. A — Beta-alanine increases intramuscular carnosine, which functions as an intracellular hydrogen ion buffer during high-intensity exercise. This buffering capacity is most beneficial for activities lasting 1-4 minutes where glycolytic H^+ accumulation is the primary performance limiter. Activities shorter than this are phosphagen-dependent, and activities longer than this are primarily aerobic — neither benefits substantially from enhanced intracellular buffering.

83. D — NSF Certified for Sport and Informed Sport are third-party certification programs that independently test supplement products for banned substances, verify label accuracy against actual contents, and screen for undeclared contaminants. Athletes subject to WADA anti-doping regulations should use only products carrying these certifications to minimize the risk of inadvertent positive drug tests from contaminated supplements.

84. B — During caloric deficit, protein needs increase to 2.0-2.4 g/kg/day to maximize preservation of lean muscle mass. The elevated intake provides additional amino acid substrate to counteract the accelerated protein degradation that occurs during energy restriction. Combined with maintained resistance training, this represents the strongest evidence-based defense against lean mass loss during intentional weight reduction.

85. C — 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. A — A 68 kg athlete at 10 g/kg/day requires 680 grams of carbohydrate daily ($68 \times 10 = 680$). This upper-end recommendation supports the extreme glycogen demands of high-volume endurance training, where daily glycogen depletion and replenishment cycles are substantial. Meeting this target requires strategic planning of carbohydrate-dense meals distributed throughout the day around training sessions.

87. D — Documented consequences of vitamin D deficiency in athletes include impaired muscle function (reduced strength, power, and neuromuscular performance), compromised immune competence (increased susceptibility to upper respiratory infections), and elevated risk of stress fractures with decreased bone mineral density. Athletes who train primarily indoors or live at northern latitudes with limited UV exposure are at greatest risk.

88. B — 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.

89. C — 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 muscle, is most active immediately post-exercise and decreases progressively over the following hours.

90. A — Plant-based athletes achieve adequate essential amino acid intake by consuming a variety of complementary protein sources throughout the day. Different plant proteins have different amino acid limitations — grains tend to be low in lysine but adequate in methionine, while legumes have the opposite profile. Combining multiple sources across meals provides all essential amino acids in adequate quantities without requiring animal products.

91. D — 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. B — 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 during the critical recovery window when enzyme sensitivity is highest.

93. C — Glutamine supplementation has limited evidence for promoting muscle growth in healthy, well-nourished athletes who already consume adequate protein from whole food sources. 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. The supplements with robust evidence include creatine, caffeine, beta-alanine, and sodium bicarbonate.

94. A — 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, 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.

95. D — 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 where measurable performance impairments begin. Individual sweat rates vary significantly based on body size, exercise intensity, and environmental conditions, so the guideline should be personalized using pre- and post-exercise body weight measurements.

SECTION 2 — PRACTICAL/APPLIED

EXERCISE TECHNIQUE (Questions 96–140)

96. B — Excessive forward lean with the chest dropping during the back squat typically indicates weakness in the thoracic extensors and core stabilizers that maintain an upright torso against the flexion torque created by the barbell. When these muscles cannot resist the forward torque, the athlete compensates by shifting the center of gravity forward, increasing lumbar stress. Strengthening the upper back and core while cueing "chest up" addresses this compensatory pattern.

97. C — Wrist hyperextension during the overhead press places the bar behind the forearm axis, creating excessive stress on the wrist extensors and carpal structures while impairing force transmission from the forearm to the bar. The wrist should remain neutral or slightly extended with the bar stacked directly over the forearm bones. This alignment maximizes pressing efficiency and protects the vulnerable wrist structures under heavy loads.

98. A — Correct Romanian deadlift technique requires slight constant knee flexion maintained throughout the entire range of motion and a neutral (flat) lumbar spine. Full knee lockout restricts the hamstring stretch and forces additional range of motion to come from lumbar flexion rather than hip flexion. Maintaining slight knee bend and a neutral spine preserves the hip hinge pattern while protecting the lumbar structures.

99. D — Medial knee collapse (valgus) during lunging indicates weakness in the hip abductors and external rotators, primarily the gluteus medius. When these muscles cannot control femoral adduction and internal rotation under load, the knee collapses inward. The correction involves cueing "drive the knee over the toes" while prescribing targeted strengthening exercises like lateral band walks and clamshells.

100. B — Initiating the pull-up with a shoulder shrug rather than lat engagement elevates the shoulders toward the ears using the upper trapezius and levator scapulae instead of depressing and retracting the scapulae with the lats. This compensation reduces the training stimulus to the latissimus dorsi — the primary target muscle. Cueing "pull your shoulder blades down and back" before bending the elbows corrects this pattern.

101. C — Pulling the bar using only the arms from the hang position eliminates the contribution of the powerful hip extensors (gluteus maximus, hamstrings) through the explosive triple extension that should drive the bar upward. The arms should remain straight during the pull, acting as passive connectors transmitting force from the explosive hip drive. Arm-only pulling severely limits bar velocity and the weight that can be cleaned.

102. A — Box squats at the appropriate depth provide a tactile reference point that the athlete can feel when they've reached the target depth. This removes the guesswork and anxiety about depth while building confidence in the bottom position. The box height is set to the desired squat depth, and the athlete learns to consistently reach it through repeated contact. Once consistent depth is achieved, the box can be gradually removed.

103. D — When the athlete pushes off significantly with the trailing foot during barbell step-ups, the rear leg assists the concentric phase that should be performed primarily by the lead (working) leg. This compensation reduces the unilateral training stimulus to the lead leg — the entire purpose of the exercise. Cueing "dead weight on the back foot" or lightly touching rather than pushing ensures the lead leg performs the majority of the work.

104. B — When spotting the front squat, the spotter positions behind the athlete rather than in front because the most common failure pattern involves the athlete sitting back or collapsing rearward. The spotter should be ready to assist at the torso (under the arms) or at the elbows to help maintain the rack position and upright posture. Gripping the barbell directly during a front squat is impractical due to the rack position.

105. C — During submaximal resistance exercise, athletes should exhale during the concentric (exertion) phase and inhale during the eccentric phase. During maximal or near-maximal

compound lifts, the Valsalva maneuver (forceful exhalation against a closed glottis) is appropriate for healthy trained athletes because the extreme intra-abdominal pressure provides essential spinal stabilization. Breath holding throughout an entire set is never recommended.

106. A — The trap 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. For an athlete recovering from a lumbar disc issue, this reduced spinal loading makes the trap bar a safer deadlift alternative.

107. D — When the dumbbells drift wide at the bottom of the press with elbows flared to 90° from the torso, the shoulder is placed in a position of maximal stress on the anterior capsule, supraspinatus tendon, and pectoralis tendon insertion. This extreme position increases the risk of shoulder impingement syndrome and pectoral tendon strain. Cueing elbows at approximately 45° from the torso reduces these risks while maintaining effective pressing mechanics.

108. B — Single-leg Romanian deadlifts develop unilateral hip hinge strength, hamstring resilience under eccentric loading, and single-leg balance and proprioceptive control. These qualities directly address the sport-specific demands of soccer, where athletes frequently decelerate, change direction, and kick from a single-leg base. The exercise also provides targeted hamstring strengthening that reduces sprint-related hamstring injury risk.

109. C — Lumbar hyperextension beyond neutral at the top of the barbell hip thrust creates compressive forces on the posterior spinal structures (facet joints, spinous processes) and potential disc stress from end-range loading. The correct top position involves a neutral spine with the hips fully extended but not hyperextended. Cueing "squeeze your glutes and tuck your ribs" at lockout maintains the protective neutral alignment.

110. A — Tempo prescriptions (such as 4-second eccentric, 2-second pause, 2-second concentric) increase the total time under tension per set, which is a primary stimulus for muscle hypertrophy. The controlled eccentric phase also develops eccentric strength and body awareness through the full range of motion. Tempo training is particularly valuable for novice and intermediate athletes developing movement control and hypertrophy.

111. D — Pulling the lat pulldown bar behind the neck places the shoulder in a combined position of extreme external rotation and horizontal abduction under load. This position compresses the supraspinatus tendon and biceps tendon against the acromion, significantly increasing impingement risk and rotator cuff stress. Pulling to the front of the chest provides equivalent lat activation without the compromised shoulder position.

112. B — The Turkish get-up requires the athlete to transition from lying to standing while maintaining a weight locked out overhead through multiple movement planes. This exercise develops shoulder stability under load, core strength in multiple directions, and total-body coordination and

proprioception. Its multi-planar demand makes it uniquely valuable for developing functional stability that transfers to athletic movement.

113. C — "Chest up, shoulder blades together" is a coaching cue that promotes thoracic extension and scapular retraction during hip hinge movements. Thoracic rounding during loaded hinge patterns shifts stress to the lumbar spine and reduces the ability to maintain a neutral spinal alignment. The cue creates an internal reference for the athlete to maintain an upright chest position throughout the movement.

114. A — The landmine press provides an angled pressing path (approximately 45-75° depending on body position) that trains the pressing pattern without requiring the full overhead range of motion that a strict press demands. For an athlete with limited overhead mobility, this modification allows continued pressing training while working to improve mobility over time, rather than forcing a compromised overhead position.

115. D — The kettlebell swing is a hip hinge movement where all force production originates from the hip extensors — primarily the gluteus maximus and hamstrings — through explosive hip extension. The arms serve only to connect the body to the kettlebell; they do not actively lift the weight. The swing should be powered by a powerful hip snap, not shoulder flexion or lumbar extension.

116. B — Cable woodchops involve rotating the trunk against cable resistance, training the core musculature in the transverse plane through rotational power production. This movement develops the obliques, transverse abdominis, and hip rotators in a functional rotational pattern. Woodchops directly develop the rotational power needed for throwing, hitting, and other rotational sport skills.

117. C — Excessive lumbar movement during the Pallof press (an anti-rotation exercise) indicates insufficient strength in the core's anti-rotation function — the ability to resist transverse plane rotational forces. The athlete lacks the stability to maintain neutral trunk alignment against the cable's rotational pull. Regression to lighter loads or shorter lever arms allows development of this anti-rotation capacity progressively.

118. A — Excessive backside mechanics — the foot spending too much time behind the body after ground contact — delays recovery of the swing leg, increasing the time between ground contacts and reducing stride frequency. Efficient sprint mechanics emphasize quick recovery of the trail leg with minimal backside extension, rapidly cycling the foot forward and upward for the next ground contact.

119. D — Band-resisted sprints apply horizontal resistance that specifically overloads the horizontal force production component of the acceleration phase. The athlete must generate greater horizontal ground reaction force to overcome the band resistance, developing the specific force application pattern needed for rapid forward acceleration from a standing or three-point start.

120. B — Proper landing mechanics require soft contact with hip and knee flexion to absorb impact forces, a neutral spine to protect the lumbar structures, and knees tracking over the toes to protect the knee joint. This athletic landing position distributes impact forces across multiple joints rather than concentrating them at a single point. Stiff-legged or heel-first landings dramatically increase impact forces and injury risk.

121. C — Sled pushes develop horizontal force production and acceleration mechanics that directly replicate the blocking demands of offensive linemen. The low body position, forward lean, and horizontal driving action against resistance mirror the force application pattern of pass and run blocking. This exercise specificity makes sled pushes one of the most sport-relevant conditioning tools for linemen.

122. A — While some forward knee travel past the toes is normal and necessary during deep squatting, excessive forward travel increases the compressive forces on the patellofemoral joint and the tensile load on the patellar tendon. Athletes with anterior knee pain or patellar tendon issues may need to modify their squat technique to limit forward knee translation through wider stance, altered foot angle, or reduced depth.

123. D — The Nordic hamstring curl provides high-intensity eccentric loading to the hamstrings at long muscle lengths, specifically targeting the conditions under which hamstring strains most commonly occur — during the late swing phase of sprinting when the hamstrings are lengthening rapidly while contracting eccentrically to decelerate knee extension. Research demonstrates significant hamstring injury risk reduction from Nordic curl programs.

124. B — "Push the floor away" is a coaching cue that promotes leg drive through the floor to initiate the deadlift, generating force through the lower extremity before the hips extend. This cue prevents the common error of pulling with the arms or back, which leads to early hip rise and spinal rounding. Thinking about pushing rather than pulling keeps the athlete connected to the ground through leg drive.

125. C — Bulgarian split squats develop unilateral strength, balance, and stability in a single-leg stance position that closely matches the movement demands of tennis — where athletes frequently lunge, reach, decelerate, and change direction from a single-leg base. The exercise addresses the bilateral strength asymmetries common in racquet sports while developing the proprioceptive control needed for dynamic court movement.

126. A — Farmer's walks develop grip endurance (sustained heavy holding), core stability (resisting trunk flexion and lateral deviation under load), and postural strength (maintaining upright alignment while walking with heavy loads). These qualities transfer directly to sport performance and general functional capacity. Loaded carries are increasingly recognized as a primary core training method superior to isolated trunk exercises.

127. D — In the jerk receiving position, the arms must be fully locked out with the bar positioned directly over or slightly behind the ears and hips, creating a stable skeletal support structure. Bent

arms cannot safely support heavy loads overhead, and the bar must be aligned vertically over the base of support for stability. The split or power position below provides the receiving base while the locked arms stabilize the load.

128. B — Excessive forward lean during dips shifts the mechanical emphasis from the triceps (which work hardest in an upright position) toward the pectoralis major (which becomes the primary mover as the torso inclines forward). While this may be intentional for chest-focused training, athletes targeting triceps development should maintain a more upright torso position throughout the dip movement.

129. C — The Pallof press with isometric holds specifically targets anti-rotation strength — the core's ability to resist rotational forces in the transverse plane. The cable or band attempts to rotate the trunk while the athlete actively maintains neutral alignment. This anti-rotation function is critical for protecting the lumbar spine during athletic movements involving rotational forces.

130. A — When the glute-ham raise produces excessive low back strain, the most likely cause is substitution of lumbar hyperextension for the hip extension that should be driven by the glutes and hamstrings. The athlete "cheats" by arching the lower back rather than extending at the hip joint. Cueing "squeeze your glutes to drive your hips forward" and maintaining a neutral spine throughout the movement corrects this pattern.

131. D — Depth drops (landing only, no rebound) are an early-phase plyometric regression designed to teach proper eccentric landing mechanics and force absorption before introducing the reactive jumping component. The athlete learns to decelerate effectively, absorb impact through flexion of the hips, knees, and ankles, and maintain neutral alignment during landing. These mechanics must be mastered before adding the concentric rebound.

132. A — If the cross-arm grip causes wrist pain, switching to a clean (front rack) grip with proper wrist and elbow positioning often resolves the issue. The clean grip distributes the bar's weight across the anterior deltoids and clavicles rather than requiring the wrists to support the load. Athletes with adequate wrist and shoulder mobility typically find the clean grip more comfortable and more stable than the cross-arm position.

133. C — Court-length shuttle sprints with 30-second rest periods create high-intensity repeated efforts with incomplete recovery — targeting the glycolytic energy system. The short rest prevents full phosphocreatine resynthesis and maintains elevated metabolic stress, developing the glycolytic capacity needed for sustained high-intensity performance across volleyball rallies, transitions, and games.

134. A — The isometric mid-thigh pull is a standardized assessment and training tool for measuring and developing peak isometric force and rate of force development. The fixed barbell position eliminates technique variables, isolating the athlete's maximal force output capability. RFD measured from the force-time curve is a critical performance variable for explosive athletes in power-dependent sports.

135. D — Scapular protraction (shoulders rounding forward) at the end of the cable row indicates the middle trapezius and rhomboids are not contracting to retract the scapulae fully. This reduces the training stimulus to these critical postural and scapular stabilizing muscles. Cueing "squeeze your shoulder blades together at the end of each pull" ensures full scapular retraction and proper activation of the target musculature.

136. B — Loaded carries (farmer's walks, waiter walks, suitcase carries) develop dynamic core stability under load in functional upright positions — how the core actually functions during athletic movement and daily activities. This approach prioritizes the core's stabilizing and force-transfer functions over the isolated trunk flexion strength developed by crunches and sit-ups, which have limited transfer to athletic performance.

137. C — Receiving the clean with elbows pointing straight down indicates the athlete failed to rotate the elbows forward into the high-elbow front rack position. This error compromises the bar's stability on the anterior deltoids and places excessive stress on the wrists and elbows. The elbows must rotate forward rapidly during the turnover so the upper arms are parallel to the floor in the receiving position.

138. A — Lateral band walks with a resistance band around the ankles or knees target the gluteus medius through hip abduction and external rotation against resistance. Strengthening this muscle corrects the medial knee collapse pattern by improving the hip's ability to stabilize the femur and prevent excessive adduction and internal rotation during squatting, running, and change-of-direction movements.

139. D — Court-length sprints with 15-25 second rest periods precisely replicate the basketball point guard's competitive demands — repeated 3-5 second sprint transitions followed by brief recovery periods during play stoppages. This protocol targets the phosphagen system at the position's actual work-to-rest ratio, ensuring conditioning adaptations transfer directly to game performance patterns.

140. B — Face pulls with external rotation are specifically programmed to maintain posterior shoulder and scapular health in athletes who perform heavy pressing 3 times per week. The high pressing volume develops the anterior deltoids and pectorals, creating a potential muscle imbalance that predisposes the shoulder to impingement and postural dysfunction. Face pulls strengthen the posterior deltoids, external rotators, and middle trapezius to balance this pressing dominance.

PROGRAM DESIGN (Questions 141–184)

141. C — The 400-meter race (approximately 48-55 seconds at near-maximal intensity) relies most heavily on the glycolytic system for sustained high-intensity ATP production throughout the event. The phosphagen system contributes to the explosive start and first 50-100 meters, while the aerobic system provides an increasing but secondary contribution during the final straight. The anaerobic glycolytic pathway is the primary limiter of 400-meter performance.

142. A — The clean and jerk meets all criteria for power exercise classification: it is structural (directly loading the axial skeleton through the spine), performed explosively (requiring maximal-velocity triple extension and overhead receiving), and involves multiple large muscle groups (quadriceps, glutes, hamstrings, back extensors, deltoids, triceps) in a coordinated explosive movement pattern requiring high neuromuscular demand.

143. D — For novice athletes with only 8 weeks of training experience, submaximal prediction using a 5-8 RM test with validated equations provides a safe, practical method for estimating maximal strength. Direct 1RM testing carries higher risk for inexperienced athletes whose technique may break down under truly maximal loads. Prediction equations based on submaximal repetitions provide a reasonable 1RM estimate while maintaining a safety margin.

144. B — Advanced athletes with 6+ years of training require greater volume per muscle group to continue stimulating adaptation — their muscles have accommodated to moderate training volumes. An upper/lower or push/pull/legs split allows greater exercise volume and variety per session for each muscle group while providing 48-72+ hours of recovery between sessions targeting the same muscles.

145. C — The 8-12 repetition range at 67-85% 1RM with 60-90 second rest periods targets muscle hypertrophy through the combined stimuli of mechanical tension (moderate-to-heavy loading) and metabolic stress (lactate accumulation, hydrogen ion concentration from short rest). This combination activates the cellular signaling cascades — including mTOR, satellite cell activation, and hormonal responses — that drive the protein synthesis and structural changes underlying muscle growth.

146. A — 87% of 200 kg = 174 kg. Five sets of 3 repetitions at this load with appropriate rest (3-5 minutes) represents a heavy strength protocol targeting near-maximal motor unit recruitment and neural adaptation. This intensity falls within the established parameters for maximal strength development in the strength-power athlete.

147. D — Triphasic training recognizes that eccentric, isometric, and concentric muscle actions each produce distinct neural and structural adaptations. Eccentric training develops force absorption and lengthening strength, isometric training develops force at specific joint angles and rate of force development, and concentric training develops force production and movement speed. The sequential emphasis progresses through each phase to optimize the transfer to explosive athletic performance.

148. B — Separating heavy strength work and speed/plyometric work on different days reflects conjugate sequencing — organizing training sessions to avoid conflicting neural demands within a single session. Heavy, slow strength work and high-velocity explosive work make competing demands on the nervous system. Separating them allows each quality to be trained with maximum quality and neural drive.

149. C — The brief 15-20 second intra-set rest between single repetitions in a cluster set allows partial phosphocreatine recovery and neural restoration. This prevents the progressive velocity decline that occurs during traditional straight sets as fatigue accumulates across repetitions. By maintaining bar velocity and movement quality across all reps, cluster sets provide a superior stimulus for power and rate of force development.

150. A — Post-activation potentiation (PAP) describes the enhancement of explosive performance following a heavy conditioning stimulus. The heavy back squat at 85% 1RM maximally activates high-threshold motor units and increases neural drive. After 3-4 minutes of rest (allowing fatigue to dissipate while potentiation persists), the subsequent jump squats benefit from enhanced neural activation, producing greater power output than without the heavy priming set.

151. D — Velocity-based training uses real-time bar velocity feedback to autoregulate training load and volume. Terminating sets when velocity drops below 20% of the fastest rep controls fatigue-induced velocity loss, ensuring every repetition maintains movement quality and maximal intent. This approach prevents athletes from grinding through slow, degraded repetitions that provide suboptimal power and RFD stimulus.

152. B — Hockey shifts of 30-45 seconds with 2-3 minute bench rest represent glycolytic-dominant demands with sufficient recovery for partial phosphocreatine replenishment. Conditioning intervals matching this work-to-rest ratio (30-45 second high-intensity efforts with 2-3 minute recovery) develop the sport-specific glycolytic capacity and repeated-effort recovery needed for competitive hockey performance.

153. C — Progressive single-leg balance challenges on increasingly unstable surfaces restore the proprioceptive function and neuromuscular control that are disrupted by ankle ligament injury. Beginning on stable surfaces and progressing to foam pads, balance boards, and sport-specific tasks systematically rebuilds the ankle's ability to detect and respond to perturbations, reducing the risk of recurrent ankle sprains.

154. A — In-season programming for a 14-week competitive season should include 2 sessions per week with reduced volume (2-3 sets per exercise rather than 4-5) but maintained intensity on key compound lifts (squats, pulls, presses at 80-85%+ 1RM). Research consistently demonstrates that intensity is the most critical variable for preventing in-season strength detraining when volume and frequency must be reduced.

155. D — The interference effect occurs when concurrent endurance and strength training produces suboptimal adaptations for one or both qualities compared to training each independently. Research suggests separating strength and endurance sessions by at least 6-8 hours minimizes this interference. When both must occur on the same day, performing strength before endurance preserves the quality of the strength training stimulus.

156. B — Wrestling matches consisting of three 2-minute periods of sustained high-intensity grappling represent glycolytic-dominant energy demands. Conditioning should use 2-minute high-intensity

intervals at wrestling-specific intensity with appropriate rest periods, developing the glycolytic capacity needed to sustain aggressive grappling across three competitive periods. The intervals should replicate the specific intensity and work-to-rest ratio of match demands.

157. C — The optimal rest between the heavy conditioning stimulus and the subsequent explosive exercise for PAP is approximately 3-5 minutes. Shorter rest intervals risk residual fatigue masking the potentiation effect. Longer rest intervals risk the potentiation dissipating before the explosive exercise begins. The 3-5 minute window allows fatigue to dissipate while the neural potentiation from the heavy stimulus is still active.

158. A — Evidence-based tapering for competition involves reducing training volume by 40-60% while maintaining or slightly increasing intensity over 1-3 weeks. This approach allows accumulated fatigue to dissipate (from the volume reduction) while preserving the neural and muscular adaptations that underpin performance (from the maintained intensity). Complete cessation of training leads to detraining without the benefit of fatigue dissipation.

159. D — French contrast training sequences a heavy compound exercise, a plyometric, a weighted explosive exercise, and an acceleration sprint within a single complex. This advanced method targets the full force-velocity spectrum — from maximal strength (heavy squat) through reactive power (plyometric) to speed-strength (weighted jump) to maximum speed (sprint) — using PAP to enhance performance at each successive point along the spectrum.

160. B — For a fall championship, the general preparation phase should begin in late spring/early summer (approximately May-June) to allow sufficient time for building the broad fitness foundation before progressing through specific preparation, pre-competition, and the competitive season. Starting earlier provides the 3-5 months needed for the systematic general-to-specific progression that produces peak performance.

161. C — A "force-deficient" athlete (strong velocity, weak force on the force-velocity profile) needs heavy resistance training at 85%+ 1RM to develop the force production capacity that is limiting their performance. The athlete already produces high velocity with light loads but lacks the maximal force foundation needed to express that velocity against heavier resistance. Correcting the deficit shifts the entire force-velocity curve upward.

162. A — The 4-phase reconditioning progression (ROM/activation → strength/hypertrophy → power/speed → sport-specific integration) reflects systematic rebuilding from the tissue healing phase through progressive functional restoration to full sport-specific readiness. Each phase builds upon the adaptations and competencies established in the preceding phase, ensuring the athlete is not exposed to demands exceeding their current structural and functional capacity.

163. D — Ascending pyramid loading transitions from hypertrophy-range stimulus (10 reps at 70%) to strength-range stimulus (4 reps at 85%) within a single session. The earlier sets provide volume and metabolic stress for hypertrophy while progressively warming up the nervous system for the

heavier sets. The final sets provide the near-maximal neural stimulus for strength development. This approach addresses multiple training goals efficiently.

164. B — Wave loading exploits post-activation potentiation — the heavier loads within each wave prime the nervous system for enhanced performance on subsequent sets. The first wave (75/85/93%) activates high-threshold motor units progressively. The second wave (77/87/95%) begins at loads the nervous system is now better prepared to handle due to the potentiation from the first wave. Athletes often report that the second wave "feels lighter."

165. C — A 35% bilateral strength asymmetry significantly exceeds the 10-15% threshold associated with increased injury risk and performance limitation. Programming should emphasize the weaker (left) leg with additional unilateral volume to reduce the imbalance. The weaker limb should perform its sets first when the athlete is freshest, and may receive additional sets beyond what the stronger limb performs until symmetry improves.

166. A — Resisted sled sprints specifically overload the horizontal force production needed for acceleration (requiring high horizontal GRF against the ground), while unresisted sprint work develops the vertical force application, limb speed, and flight mechanics needed for maximum velocity. Together, these complementary methods address both primary components of sprint performance across the velocity continuum.

167. D — The deload structure (volume reduced 40-50%, intensity maintained) manages accumulated fatigue from the three loading weeks while preserving the neural and muscular stimulus through maintained training intensity. The 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 subsequent loading cycle.

168. B — Descending sets (drop sets) extend the set beyond initial concentric failure by immediately reducing the load and performing additional repetitions. This technique increases the total mechanical tension and metabolic stress beyond what a single straight set provides, driving greater stimulus for muscle hypertrophy through extended time under tension, additional motor unit recruitment (as fatigued units are replaced), and accumulated metabolic byproducts.

169. C — A two-sport athlete with distinct fall and spring competitive seasons requires two complete periodization cycles within a single year — double periodization. Each cycle includes its own preparatory (general and specific), competitive, and transition phases. The transition period between seasons provides recovery before the next cycle begins, while the preparatory phases build the fitness foundation specific to each sport's demands.

170. A — A significant quadriceps-to-hamstring strength imbalance (quadriceps dominant) increases ACL injury risk during deceleration and cutting because insufficient hamstring co-contraction fails to resist the anterior tibial translation caused by quadriceps contraction. The hamstrings serve as dynamic ACL synergists during these movements. This risk is particularly elevated in female athletes, who demonstrate higher rates of quadriceps dominance and ACL injury.

171. D — Plyometric push-ups qualify as upper body plyometrics because they require a rapid eccentric-to-concentric transition exploiting the stretch-shortening cycle. The hands leave the surface during the concentric phase (demonstrating explosive force production), and the rapid lowering-to-pushing transition stores and returns elastic energy while activating the stretch reflex — the defining characteristics of plyometric exercise.

172. B — An upper/lower split with 4 training days per week allows greater volume per muscle group per session (since only half the body is trained each day) while providing 72+ hours between sessions targeting the same muscle groups. This organization enables the higher per-muscle-group volume that advanced athletes need to continue stimulating adaptation while maintaining adequate recovery between stimuli.

173. C — The hang clean high pull preserves the explosive triple extension and pulling power development of the full clean while eliminating the front rack receiving position that the athlete cannot safely perform due to their wrist injury. The pull-to-sternum height develops the same rate of force development, hip extension power, and upper body pulling mechanics without the wrist demands of the catch.

174. A — Agility ladder drills primarily develop foot speed, coordination, and neuromuscular activation. They are most appropriately used as a warmup component or supplementary training tool. However, they do not develop true reactive agility because the movement patterns are preplanned rather than requiring perceptual-cognitive decision-making in response to unpredictable stimuli. Sport-specific agility requires separate reactive training methods.

175. D — The standard Wingate anaerobic test protocol uses 30 seconds of maximal-effort cycling against a resistance standardized to the athlete's body mass (typically 0.075 kg per kg body weight). This duration allows assessment of both peak power (highest power output, typically in the first 3-5 seconds, reflecting phosphagen capacity) and mean power (average across 30 seconds, reflecting anaerobic/glycolytic capacity), plus the fatigue index.

176. B — Heavy sled pulls with slow, deliberate movement develop maximal horizontal force production and starting strength — the ability to generate high force from a dead stop against heavy resistance. Unlike lighter sled work at higher velocities targeting acceleration mechanics, heavy pulls with slow movement specifically develop the force production end of the force-velocity continuum for horizontal pushing and pulling applications.

177. C — According to NSCA exercise order guidelines, core exercises and single-joint exercises are performed last in the session, after all power/explosive exercises, core multi-joint exercises, and assistance exercises. Front planks are a core stability exercise that should be placed at the end of the session. Power cleans are performed first (explosive), followed by squats and bench press (core multi-joint), then rows and curls, then planks.

178. A — Three sets of 20 repetitions at 55% 1RM with 30-second rest is a muscular endurance protocol. The high repetitions, low-to-moderate load, and minimal rest periods maximize sustained

metabolic demand and force the muscles to perform work under progressive fatigue. This trains the specific adaptation of fatigue resistance — the ability to sustain force output across many repetitions with accumulating metabolic stress.

179. D — For an outdoor track sprinter competing at nationals in late June, the specific preparation phase should span approximately March through May. This timing allows the preceding general preparation phase (December-February) to build the foundational fitness, while the specific preparation develops sport-specific power, speed, and competition readiness leading into the June championship.

180. B — Band-assisted pull-ups reduce the effective bodyweight resistance through the pulling motion while maintaining the full range-of-motion pulling pattern. The band provides the most assistance at the bottom (where it is most stretched) and the least at the top (where it is least stretched), closely matching the strength curve of the pull-up. This allows athletes who cannot perform unassisted pull-ups to train the complete movement pattern progressively.

181. C — Reactive agility drills where athletes respond to visual or auditory cues while sprinting develop the perceptual-cognitive processing component combined with physical direction change that defines true agility. Preplanned COD drills develop only the physical component (deceleration, reacceleration, body reorientation) without the decision-making under uncertainty that differentiates game-speed agility from choreographed movement.

182. A — Strongman-style training with tire flips, farmer's walks, and sled drags develops total-body functional strength (multi-joint, multi-planar force production), explosive power (tire flips, sled starts), grip endurance (sustained heavy holds during carries), and anaerobic work capacity (sustained high-effort work with minimal rest). These qualities directly transfer to the physical demands of rugby forward play.

183. C — The hang snatch eliminates the first pull from the floor, which has the highest technique demands (maintaining proper back angle while breaking the bar from the ground). Starting from the hang position simplifies the movement while preserving the explosive second pull, overhead receiving, and catching mechanics. For field sport athletes who use Olympic lift derivatives for power development rather than competitive lifting, this modification optimizes the risk-benefit ratio.

184. B — Athletes with long femurs relative to torso length experience greater forward torso lean during conventional deadlifts, increasing the moment arm on the lumbar spine. The sumo stance with a wider foot position and externally rotated hips allows a more upright torso by reducing the effective femur length (the horizontal distance the hips must travel behind the bar). This biomechanical advantage reduces lumbar loading for this specific body type.

TESTING AND EVALUATION (Questions 185–206)

185. C — A reactive agility test that requires athletes to respond to visual or auditory cues while changing direction is the most appropriate assessment because the question specifically asks about agility with a reactive component. The T-test and pro agility shuttle assess only preplanned change-of-direction speed without the perceptual-cognitive decision-making element that defines true agility. Reactive tests capture this critical additional dimension.

186. A — Inter-tester variability in skinfold site selection, compression technique, caliper placement angle, and reading speed is the primary source of measurement error in skinfold assessment. Having the same technician perform all measurements eliminates this between-tester variability, ensuring that changes observed over time reflect true body composition changes rather than differences in measurement technique between assessors.

187. D — Standard 5RM-to-1RM prediction ratios estimate that a 5RM represents approximately 85-87% of 1RM. Using this ratio, 150 kg ÷ 0.87 ≈ 172 kg, falling within the range of 169-175 kg. The actual tested 1RM of 175 kg confirms the validity of this prediction range. Prediction equations are most accurate when based on repetitions within the 10-or-fewer range.

188. B — The active knee extension (AKE) test isolates hamstring flexibility by measuring knee extension range with the hip flexed to 90° in a supine position. Unlike the sit-and-reach, which is influenced by lumbar flexibility and limb proportions (arm-to-leg-to-trunk ratio), the AKE provides a hamstring-specific measurement unconfounded by these extraneous variables. This specificity allows targeted identification of true hamstring tightness.

189. C — Exertional chest pain, exercise-induced syncope, and a family history of sudden cardiac death are high-risk findings on pre-participation screening that require physician clearance before any exercise participation. These symptoms may indicate underlying cardiovascular conditions (hypertrophic cardiomyopathy, coronary artery anomalies, arrhythmias) that could result in sudden cardiac death during exercise. Immediate medical referral is mandatory.

190. A — The force plate provides peak ground reaction force, rate of force development (the slope of the force-time curve), impulse (the area under the force-time curve), and power output in addition to jump height. The Vertec device measures only jump height from the difference between standing reach and jumping reach. The comprehensive biomechanical data from the force plate enables detailed performance analysis impossible with simpler methods.

191. D — The Yo-Yo Intermittent Recovery Test is specifically designed for intermittent team sports (soccer, basketball, hockey, rugby) where athletes perform repeated high-intensity efforts interspersed with brief recovery periods. The test assesses the athlete's ability to recover and repeat high-intensity running bouts — a capacity directly relevant to match fitness — rather than steady-state aerobic capacity measured by continuous running tests.

192. B — The 1RM is defined as the last weight successfully lifted with acceptable technique through the full range of motion. The athlete completed 165 kg with proper depth and technique but demonstrated a technique breakdown (good morning pattern with hips rising faster than chest) at 170 kg. The failed technique disqualifies the 170 kg attempt, and 165 kg is recorded as the 1RM.

193. C — The testing profile reveals a clear pattern: speed (40th), power (45th), and agility (52nd) are all below the 55th percentile, while maximal strength (78-80th) and aerobic endurance (72nd) are well-developed. This discrepancy indicates the athlete has adequate strength and fitness but cannot express these qualities explosively. Programming should prioritize explosive training — plyometrics, Olympic lifts, and sprint work — to develop the speed-power deficit.

194. A — A score of 1 (pain) on any FMS movement screen indicates that the athlete experienced pain during that specific movement pattern. Pain during screening suggests possible underlying pathology that requires clinical assessment by a qualified medical professional (physician, athletic trainer, physical therapist) before training can safely proceed. Loading a painful movement pattern risks worsening an undiagnosed condition.

195. D — The 300-yard shuttle is classified as an anaerobic capacity field test measuring glycolytic performance. The total effort duration (typically 50-70 seconds at maximal effort) falls within the glycolytic-dominant range, and the multiple direction changes add a metabolic cost beyond straight-line running. The total completion time provides a practical measure of the athlete's ability to sustain high-intensity effort powered primarily by anaerobic glycolysis.

196. B — Most normative tables classify 50+ push-up repetitions as "excellent" for young adult males (ages 18-25). Push-up test norms vary by age and sex, with performance categories ranging from "very poor" through "excellent." The test provides a practical, equipment-free assessment of upper body muscular endurance that can be administered to large groups simultaneously with minimal setup.

197. C — An improving reactive strength index (RSI = jump height ÷ ground contact time) over time indicates enhanced reactive strength — the athlete is achieving greater jump height with equal or shorter ground contact time. This reflects improved stretch-shortening cycle efficiency, greater musculotendinous stiffness, and enhanced neuromuscular function. RSI is a key performance indicator for athletes in power and speed-dependent sports.

198. A — Peak power during the Wingate test occurs within the first few seconds (typically 3-5 seconds) when the phosphagen system is providing the highest instantaneous rate of ATP production. This peak power value reflects the athlete's maximal anaerobic power capacity — the highest rate of energy production achievable from immediate energy sources (ATP and PCr). Mean power across the full 30 seconds reflects anaerobic capacity.

199. A — Asymmetry index = (stronger − weaker) ÷ stronger × 100 = (28 − 22) ÷ 28 × 100 ≈ 21.4%. This value exceeds the commonly cited 10-15% clinical threshold for acceptable bilateral difference, indicating a clinically significant asymmetry warranting targeted corrective

programming with unilateral emphasis on the weaker (left) leg and possible medical evaluation for underlying pathology.

200. B — The hexagonal bar jump test evaluates lower body power with an external load (the hex bar) in a movement pattern that resembles the athletic stance more closely than a traditional vertical jump. For football linemen who rarely jump from a fully upright position with no external load, the hex bar jump provides a more sport-relevant assessment of explosive lower body power in a loaded, semi-squatted position.

201. C — The repeated sprint ability (RSA) test specifically measures the athlete's capacity to maintain sprint performance across multiple efforts with incomplete recovery — a quality directly relevant to team sport performance. While single-sprint tests measure peak speed, RSA testing reveals how well the athlete recovers between sprints and maintains performance quality across the demands of repeated high-intensity efforts typical in match play.

202. D — An eccentric utilization ratio of 1.05 (CMJ only 5% higher than SJ) compared to 1.25 (25% higher) indicates poorer SSC utilization in the first athlete. Despite equal SJ heights (reflecting equal concentric-only ability), the first athlete derives significantly less additional performance from the countermovement. This suggests deficient elastic energy storage/return, stretch reflex contribution, or amortization phase efficiency.

203. C — Both the Lewis formula and the Sayers equation for estimating vertical jump power require two input variables: the athlete's body weight (in kg) and their jump height (in cm or m). These two variables are combined in different mathematical relationships to estimate peak power output. The Sayers equation is generally considered more accurate than the older Lewis formula.

204. B — The medicine ball power throw measures upper body explosive power through the velocity of release — how quickly and forcefully the athlete can project the ball. The bench press 1RM measures maximal upper body strength at slow speeds. For basketball, where shooting, passing, and rebounding require rapid force production rather than maximal slow-speed strength, the medicine ball throw provides a more sport-relevant assessment of upper body power.

205. C — The test battery is ordered with speed, power, and agility tests first (vertical jump, pro agility, 60-yard sprint) followed by strength tests (bench press, squat). This sequence prevents fatigue from heavy strength testing from affecting the time-sensitive and power-dependent measures. Speed and power tests are more sensitive to fatigue effects than strength tests, making this ordering critical for obtaining valid results across all assessments.

206. A — For a change between testing sessions to be considered meaningful (representing true performance improvement rather than measurement noise), the magnitude of change must exceed the test's minimal detectable change (MDC) or smallest worthwhile change (SWC). These statistical thresholds account for the inherent measurement variability of each specific test. Changes below these thresholds cannot be confidently distinguished from normal test-retest variability.

ORGANIZATION AND ADMINISTRATION (Questions 207–220)

207. D — Using the NSCA's upper guideline of 60 square feet per athlete: 65 athletes × 60 sq ft = 3,900 square feet of recommended training area for peak capacity. This guideline ensures adequate space for safe movement, equipment clearance, emergency access, and supervision visibility during the busiest training periods when injury risk is highest due to increased traffic and congestion.

208. B — A comprehensive emergency action plan must specify personnel roles (who does what during an emergency), communication procedures (how to contact EMS and hospital), equipment locations (AED, first aid kit, spine board), emergency contact numbers (EMS, team physician, athletic trainer), facility access routes for EMS (which doors to open, how to guide responders), and regular rehearsal schedules to ensure all staff can execute the plan under stress.

209. C — An AED with an expired battery may fail to deliver a life-saving shock during a cardiac emergency. The battery must be replaced immediately upon discovery of the expiration, and the maintenance action must be documented in the equipment log with date, action taken, and responsible staff member. Regular AED inspection (monthly) should catch expired batteries before the expiration date, not 4 months after.

210. A — Athletes with sickle cell trait face elevated risk of exertional sickling during high-intensity exercise, particularly at altitude, in heat, or with dehydration. Appropriate precautions include gradual acclimatization to new training environments, emphasis on adequate hydration, modification of high-intensity interval protocols in challenging conditions, and education of all staff on the warning signs of exertional sickling (muscle pain, weakness, inability to continue).

211. D — When a single specialist supervises 35 athletes simultaneously, maintaining visual contact with all training areas is essential. Exercise selection must be restricted to movements that are safe under the available supervision ratio — excluding technically demanding exercises (Olympic lifts, heavy maximal attempts) that require closer monitoring. The specialist must never leave the training floor or allow unsupervised training of complex movements.

212. B — Professional liability insurance for CSCS-credentialed professionals provides financial protection against negligence claims alleging that the professional's services (program design, exercise instruction, supervision, testing) caused injury or harm to an athlete. This coverage is essential because even well-designed programs carry inherent risk, and allegations of negligence can result in significant legal defense costs and potential damage awards.

213. C — Punishment workouts — using excessive, unplanned exercise volume as disciplinary action — violate professional standards because they expose athletes to injury risk from training stress that was not programmed based on sound exercise science principles. The CSCS must decline implementation, explain the injury risk and liability concerns to the sport coach, and advocate for appropriate evidence-based training practices.

214. A — A comprehensive facility policy manual should include the emergency action plan, equipment inspection and maintenance protocols, required supervision ratios, athlete conduct and safety standards, and injury/incident reporting procedures. These documents establish the facility's standard of care, communicate expectations to all stakeholders, and provide legal documentation of the policies and procedures in place if liability questions arise.

215. D — A frayed cable with exposed wire strands presents an imminent failure risk — the cable could snap under load, causing the weight stack to fall and potentially injuring an athlete. The equipment must be immediately removed from service, tagged as out of order to prevent use, documented in the maintenance log with a description of the damage, and repaired or replaced by qualified technicians before returning to service.

216. B — The athlete must complete the standard check-in process and prescribed warmup before beginning any loaded exercises, regardless of personal preference. Check-in procedures ensure medical clearance documentation is current and tracks attendance for supervision purposes. The prescribed warmup prepares tissues for loading and reduces injury risk. These non-negotiable safety protocols apply to all athletes equally.

217. C — If facility policy requires physician clearance (MD, DO, or qualified provider as specified by policy), a chiropractor's signature may not meet the policy requirements. The specialist should respectfully explain the policy to the parent and require a clearance form from a provider meeting the facility's established standards. This protects both the athlete (ensuring appropriate medical screening) and the facility (demonstrating adherence to stated policies).

218. A — Incorrect spotting instructions create immediate safety risk for the athlete being spotted. The specialist must immediately correct the instruction, physically demonstrate proper spotting technique for the specific exercise, and provide direct supervision of the intern until competency is established. Interns require active mentorship and should not provide unsupervised safety-critical instruction to athletes.

219. D — Operating at twice the required supervision ratio (42:1 vs. 20:1 maximum) violates the facility's insurance requirements and creates unacceptable safety risk. The specialist must either restrict the session to 20 athletes (the maximum for one supervisor) or arrange for additional qualified supervision before allowing the remaining athletes to train. Violating insurance ratios may void coverage if an incident occurs.

220. B — Equipment maintenance (ensuring all equipment is safe and functional), safety equipment (AED with current batteries, fully stocked first aid supplies), and staff professional development (continuing education maintaining CSCS certification and emergency response skills) directly protect athlete safety and support quality programming. These expenditure categories should receive the highest budget priority because they address the facility's primary obligations of safety and professional competence.