PRACTICE EXAM 6: CSCS FULL-LENGTH SIMULATION

SECTION 1 — SCIENTIFIC FOUNDATIONS

95 Questions | 1.5 Hours Recommended

EXERCISE SCIENCE (Questions 1–52)

1. A strength and conditioning specialist reviews a muscle biopsy from a 20-year-old male sprinter. The report indicates 35% Type I, 45% Type IIa, and 20% Type IIx fibers. After 6 months of heavy resistance training and sprint work, the specialist expects the repeat biopsy to show which change in the Type IIx proportion?

A. A decrease in Type IIx fibers with a corresponding increase in Type IIa fibers, reflecting the well-documented training-induced conversion within the Type II subtypes

B. An increase in Type IIx fibers because heavy training selectively stimulates the most explosive fiber type

C. Complete conversion of all Type IIx fibers to Type I fibers through direct phenotypic transformation

D. No change in any fiber type because fiber distribution is permanently fixed at birth and cannot be altered

2. The sarcolemma of a skeletal muscle fiber has specialized invaginations called transverse tubules (T-tubules) that extend from the surface deep into the fiber's interior. During excitation-contraction coupling, the T-tubules serve which critical function?

A. Storing and releasing calcium directly into the sarcoplasm without involvement of any other organelle

B. Synthesizing ATP through oxidative phosphorylation within the T-tubule membrane walls

C. Conducting the action potential from the surface of the fiber into the interior to trigger calcium release from the sarcoplasmic reticulum

D. Producing acetylcholine that crosses the synaptic cleft at the neuromuscular junction

3. A collegiate athlete has been resistance training for 8 years and has a well-developed strength base. Their squat 1RM has increased only 4% in the past 12 months despite consistent training. A novice athlete of similar body composition who started the same program 12 months ago increased their squat 1RM by 48%. The dramatically different rates of improvement are best explained by which principle?

A. The novice has superior genetic talent that allows unlimited strength development

B. The experienced athlete has a medical condition preventing further adaptation

C. Both athletes should be producing identical rates of improvement regardless of training history

D. The law of diminishing returns — the experienced athlete has captured most available neural and structural adaptations, so progressively greater training specificity is needed for smaller incremental gains

4. The sliding filament theory explains that muscle contraction occurs through the sliding of thin (actin) filaments over thick (myosin) filaments without any change in the length of the individual filaments themselves. During this process, which sarcomere band remains constant in width?

A. The I-band, which contains only thin filaments and narrows as they slide toward the center

B. The A-band, which represents the full length of the thick filaments and does not change because the myosin filaments themselves do not shorten

C. The H-zone, which disappears completely during maximal contraction

D. The Z-line, which moves closer to the adjacent Z-line as the sarcomere shortens

5. An exercise physiologist measures blood lactate in a trained cyclist during a progressive intensity test. At 150 watts, lactate is 1.1 mmol/L. At 200 watts, it is 1.8 mmol/L. At 250 watts, it rises sharply to 4.5 mmol/L. At 275 watts, it reaches 7.2 mmol/L. The lactate threshold — the intensity where lactate production began exceeding clearance capacity — occurred at approximately which workload?

A. Between 200 and 250 watts, where the exponential rise in blood lactate indicates that production began exceeding the body's capacity to clear it

B. At 150 watts where the first lactate measurement was recorded during the progressive test

C. At 275 watts where the highest absolute lactate concentration was measured

D. The lactate threshold cannot be identified from progressive exercise test data

6. During a maximal isometric mid-thigh pull on a force plate, an athlete produces a peak force of 3,500 N in 180 milliseconds. A second athlete of identical body weight produces the same 3,500 N peak force in 320 milliseconds. Which athlete demonstrates the superior rate of force development and what performance advantage does this provide?

A. The second athlete because slower force development indicates greater total impulse production

B. Both athletes have identical RFD because they produce the same peak force regardless of timing

C. The first athlete, because reaching the same peak force in less time (180 vs. 320 ms) indicates a faster rate of force development — critical for athletic movements with limited ground contact time

D. RFD cannot be compared between athletes who produce the same absolute peak force

7. A strength and conditioning specialist observes that an athlete's hamstrings cramp during the final repetitions of a heavy Romanian deadlift set. The athlete has been holding the eccentric stretch at the bottom position for 3 seconds on each rep. The cramping is most likely caused by sustained activation of which proprioceptor?

A. The Pacinian corpuscle in the subcutaneous tissue detecting vibration from the barbell oscillation

B. The Ruffini endings in the joint capsule detecting sustained pressure changes at the hip

C. The free nerve endings in the skin detecting temperature changes from increased blood flow

D. The muscle spindle, which detects the sustained stretch at the bottom position and generates a persistent stretch reflex that contributes to involuntary contraction and cramping

8. An athlete performs a PNF contract-relax stretch on the hamstrings. The 6-second isometric contraction of the hamstrings against resistance activates the Golgi tendon organ, which then produces autogenic inhibition. This inhibition allows a greater subsequent stretch because of which neurological mechanism?

A. The GTO amplifies the stretch reflex causing the hamstrings to contract more forcefully

B. The GTO sends inhibitory signals through an interneuron that reduce alpha motor neuron activity to the hamstrings, temporarily decreasing their resistance to the stretch

C. The GTO directly relaxes the antagonist (quadriceps) allowing the hamstrings to lengthen further

D. The GTO activates gamma motor neurons that reset the muscle spindle to a longer resting length

9. An athlete performs a countermovement jump (CMJ) and a static squat jump (SJ). The CMJ height is 65 cm while the SJ height is 54 cm — an 11 cm difference. This difference represents the contribution of which neuromuscular mechanism to the countermovement jump?

A. The stretch-shortening cycle — stored elastic energy in the musculotendinous unit and the stretch reflex contribution from the rapid countermovement augmenting concentric force production

B. Greater phosphocreatine availability in the quadriceps during the countermovement jump

C. Enhanced aerobic energy production during the longer ground contact time of the CMJ

D. Reduced bodyweight during the countermovement due to momentary weightlessness at the transition

10. During progressive exercise from rest to maximal intensity, stroke volume increases up to approximately 40% to 60% of VO_2max and then plateaus. Further increases in cardiac output beyond this plateau are achieved primarily through which cardiovascular mechanism?

A. Continued increases in stroke volume through progressive eccentric cardiac hypertrophy during the test

B. Redistribution of blood from the brain to the working muscles during the final stages of the test

C. Continued increases in heart rate through sympathetic nervous system activation until the age-predicted maximum is approached

D. Increases in blood viscosity that accelerate flow velocity through the circulatory system

11. A strength and conditioning specialist is explaining cardiovascular adaptations to a group of athletes. Chronic endurance training produces eccentric cardiac hypertrophy (increased chamber size), while chronic resistance training produces concentric cardiac hypertrophy (increased wall thickness). The functional difference most relevant to the strength and conditioning specialist is which of the following?

A. Eccentric hypertrophy reduces stroke volume while concentric hypertrophy increases it

B. Both types produce identical functional outcomes with no practical distinction for programming

C. Concentric hypertrophy is always a pathological condition requiring immediate medical intervention

D. Eccentric hypertrophy increases maximal stroke volume and cardiac output (relevant for endurance performance), while concentric hypertrophy increases pressure-generating capacity (relevant for tolerating acute blood pressure spikes during heavy lifting)

12. During heavy resistance exercise with the Valsalva maneuver, blood pressure spikes dramatically. Research has documented values exceeding 400/300 mmHg during maximal lifts. For healthy, trained athletes, this acute response is generally well-tolerated. However, this technique is contraindicated for which specific population?

A. Professional powerlifters competing in sanctioned meets with medical supervision available

B. Individuals with uncontrolled hypertension or cardiovascular disease where extreme pressure spikes may exceed the structural or functional limits of the compromised cardiovascular system

C. Collegiate athletes with current medical clearance performing heavy compound lifts

D. Military personnel performing operational fitness assessments under qualified supervision

13. Testosterone is the primary androgenic-anabolic hormone promoting muscle protein synthesis. The acute testosterone response to resistance exercise is greatest with which training protocol characteristics?

A. Large muscle mass exercises, moderate-to-high intensity (70–85% 1RM), moderate-to-high volume (multiple sets), and short rest periods (60–90 seconds)

B. Single-joint isolation exercises targeting small muscle groups with very light loads and long rest

C. Exclusive flexibility training with no resistance component at any intensity level

D. Complete rest without any exercise stimulus to maximize basal testosterone pulsatility

14. An athlete's blood work reveals suppressed testosterone, elevated resting cortisol, and a declining testosterone-to-cortisol ratio over 8 consecutive weeks. The athlete reports persistent fatigue, declining performance, insomnia, and loss of motivation. This clinical picture is most consistent with which condition?

A. Optimal physiological adaptation indicating the athlete is peaking for competition

B. Normal hormonal fluctuation that occurs during every training cycle and requires no intervention

C. Overtraining syndrome — a chronic maladaptive state where cumulative training stress has exceeded recovery capacity, producing systemic hormonal disruption

D. Acute delayed-onset muscle soreness from a single unusually intense training session

15. Growth hormone (GH) produced by the anterior pituitary gland stimulates the release of insulin-like growth factor-1 (IGF-1) from the liver and locally within skeletal muscle. The locally produced muscle-derived variant, mechano-growth factor (MGF), is particularly important for which adaptive process?

A. Increasing the rate of glycolysis during high-intensity anaerobic exercise

B. Enhancing the conduction velocity of motor neurons innervating the working muscles

C. Reducing blood lactate concentration during prolonged submaximal exercise

D. Activating satellite cells and stimulating local muscle protein synthesis through the mTOR signaling pathway in response to mechanical loading

16. The SAID principle (Specific Adaptations to Imposed Demands) predicts that training adaptations are specific to the type of stress applied. A strength and conditioning specialist designs a program for a competitive high jumper consisting exclusively of heavy bilateral back squats performed at slow, controlled tempos with no jumping, plyometric, or unilateral exercises. This program violates the SAID principle because it fails to address which sport-specific demands?

A. The bilateral squat pattern provides all the specificity needed for high jump performance

B. Unilateral takeoff power, rapid rate of force development, vertical power from a single-leg base, and the stretch-shortening cycle mechanics that define the high jump takeoff

C. Only maximal strength is relevant to jumping performance regardless of how it is expressed

D. The SAID principle does not apply to jumping sports because jumps are exclusively technique-dependent

17. An exercise physiologist measures an athlete's VO_2 during a graded treadmill test. At stage 8, the athlete's VO_2 reaches 55 mL/kg/min and does not increase further despite two additional stages of increased speed and grade. The respiratory exchange ratio is 1.18 and blood lactate is 11 mmol/L. This VO_2 plateau confirms that the athlete has reached which physiological measure?

A. Maximal oxygen consumption (VO_2max) — the absolute ceiling of the body's capacity to consume and utilize oxygen, confirmed by the plateau despite increasing workload along with the elevated RER and lactate values

B. The lactate threshold at 55 mL/kg/min indicating the onset of blood lactate accumulation

C. The ventilatory threshold at 55 mL/kg/min indicating the onset of hyperventilation

D. The resting metabolic rate measured under exercise conditions

18. The phosphagen system regenerates ATP through the creatine kinase reaction (PCr + ADP → ATP + Cr). Full replenishment of phosphocreatine stores after maximal depletion requires approximately 3 to 5 minutes of passive rest. An athlete performing 6-second maximal sprints needs this rest interval to ensure which training outcome?

A. Complete glycogen resynthesis in the quadriceps and hamstrings between sprint efforts

B. Allowing the oxidative system to become dominant for the subsequent sprint effort

C. Reducing blood lactate concentration to zero before initiating the next maximal sprint

D. Near-complete PCr availability for the next sprint, ensuring maximal phosphagen system contribution and maintaining the quality of each maximal-effort repetition

19. During a 200-meter sprint lasting approximately 22 seconds at near-maximal intensity, which energy system provides the dominant contribution to ATP production throughout the race?

A. The oxidative system through sustained aerobic metabolism of fat and carbohydrate

B. The phosphagen system exclusively for the entire 22-second duration of the sprint

C. The glycolytic system, because the 22-second duration at near-maximal intensity falls within the glycolytic-dominant range where rapid breakdown of muscle glycogen provides the primary ATP

D. Beta-oxidation of intramuscular triglycerides providing the majority of energy at this intensity

20. A strength and conditioning specialist prescribes interval training with 30-second all-out cycling efforts for a team of soccer players. By the end of each 30-second effort, the athletes report intense quadriceps burning and difficulty maintaining pedal cadence. The primary metabolic cause of this acute fatigue is which of the following?

A. Complete depletion of intramuscular triglyceride stores within the first 10 seconds of each interval

B. Hydrogen ion accumulation from rapid glycolysis reducing intracellular pH, impairing cross-bridge cycling and enzyme function

C. Excessive oxygen delivery causing oxidative damage to the contractile proteins in the quadriceps

D. Protein catabolism from cortisol release that has degraded the structural integrity of the muscle fibers

21. At rest and during low-intensity exercise (below approximately 50% of VO_2max), the dominant fuel substrate for ATP production is fat, metabolized through beta-oxidation and oxidative phosphorylation. As exercise intensity increases above 60% to 75% of VO_2max, the dominant fuel substrate shifts to which alternative?

A. Protein through amino acid deamination and the urea cycle as the primary energy pathway

B. Phosphocreatine through the creatine kinase reaction as the exclusive energy source above 60% VO_2max

C. Exclusively lactate recycled through the Cori cycle without any direct substrate oxidation

D. Carbohydrate (muscle glycogen and blood glucose) metabolized through glycolysis and oxidative metabolism at a rate fast enough to meet the escalating energy demand

22. The electron transport chain (ETC) is located on the inner mitochondrial membrane and is responsible for producing the majority of ATP during aerobic metabolism. The ETC requires which molecule as the final electron acceptor to function?

A. Oxygen, which combines with electrons and hydrogen ions to form water — without it, the entire chain stops and aerobic ATP production ceases

B. Carbon dioxide, which is produced by the Krebs cycle and recycled into the ETC

C. NADH, which is the final product of the ETC rather than an input

D. Lactate, which provides electrons directly to the first complex of the chain

23. A strength and conditioning specialist is explaining the concept of the crossover point to an athlete. The crossover concept describes which metabolic transition during progressive exercise?

A. The transition from aerobic to exclusively anaerobic metabolism at all intensities above 50% VO_2max

B. The point at which the athlete reaches VO_2max and oxygen consumption can no longer increase

C. The intensity at which the body shifts from predominantly fat oxidation to predominantly carbohydrate oxidation as the primary fuel source

D. The transition from Type I to Type IIx motor unit recruitment during increasing force demands

24. Newton's Second Law (F = ma) states that acceleration is proportional to net force and inversely proportional to mass. A 90 kg athlete performing a vertical jump produces a peak ground reaction force of 2,700 N. Given gravitational force of approximately 883 N (90 × 9.81), the net upward force and resulting acceleration are which of the following?

A. Net force = 2,700 N because gravity does not need to be subtracted from the total GRF

B. Net force = 1,817 N upward (2,700 – 883); acceleration = approximately 20.2 m/s^2 upward (1,817 ÷ 90)

C. Net force = 0 N because the GRF exactly equals gravity during all phases of the jump

D. Acceleration cannot be calculated from force and mass data

25. During the acceleration phase of a sprint (first 10 to 30 meters), the athlete's body should be in a pronounced forward lean. This body position is biomechanically important because it allows the athlete to direct ground reaction forces in which manner?

A. Vertically upward to maximize flight time between strides during early acceleration

B. Mediolaterally to provide lateral stability during the single-leg support phase

C. In a random direction because body lean has no effect on GRF direction during sprinting

D. Primarily horizontally backward against the ground, producing the forward-directed reaction force needed to overcome the body's inertia and generate forward momentum

26. A biomechanical analysis of an athlete's bench press reveals that the sticking point occurs approximately 4 inches above the chest. At this position, the moment arm of the barbell relative to the shoulder joint is near its maximum and the pectoralis major is in a lengthened position. The combined effect of these two factors is which of the following?

A. Reduced torque demand because the longer moment arm decreases the force requirement

B. Improved mechanical efficiency because the lengthened position optimizes all cross-bridge formation

C. Maximum torque demand on the pressing muscles because the large moment arm requires greater force, while the lengthened pectoralis has suboptimal actin-myosin overlap reducing available cross-bridges

D. No biomechanical consequence because bar position does not affect joint loading during pressing

27. Third-class levers — the most common arrangement in the human body — have the effort (muscle insertion) between the fulcrum (joint) and the resistance (external load). This arrangement means the effort arm is shorter than the resistance arm, creating which mechanical consequence?

A. The muscle must produce force many times greater than the external load to produce movement, because the short effort arm creates a mechanical disadvantage for force — but the arrangement favors speed and range of motion at the distal end

B. The muscle produces force equal to the external load at all joint angles throughout the range of motion

C. The lever provides a mechanical advantage greater than one, amplifying force at the expense of speed

D. Third-class levers produce no mechanical advantage or disadvantage under any loading condition

28. The Golgi tendon organ (GTO) is located at the musculotendinous junction and detects changes in muscle tension. When activated during high-tension situations, the GTO produces autogenic inhibition that limits maximal voluntary force production. Chronic heavy resistance training has been shown to do which of the following to the GTO's inhibitory influence?

A. Increase the GTO's sensitivity so that it activates at lower tension levels as a safety adaptation

B. Completely eliminate the GTO from the musculotendinous junction through structural remodeling

C. Have no effect on the GTO because proprioceptors cannot be modified by any training stimulus

D. Reduce the GTO's inhibitory influence, allowing trained athletes to voluntarily produce force closer to the structural capacity of their musculotendinous units

29. An athlete performs a plyometric depth jump from a 60 cm box. The amortization phase — the brief transition between eccentric landing and concentric takeoff — must be minimized to maximize the stretch-shortening cycle benefit. If the amortization phase exceeds approximately 250 milliseconds, which consequence occurs?

A. The stretch reflex is amplified because the muscle spindle has additional time to generate a stronger response

B. Stored elastic energy dissipates as heat and the stretch reflex contribution diminishes, reducing the total power enhancement and defeating the purpose of the plyometric exercise

C. The eccentric phase is completely eliminated and the exercise becomes a purely concentric jump

D. Muscle damage is prevented because the longer transition protects the connective tissues from stress

30. Wolff's Law states that bone remodels in response to the mechanical stresses placed upon it. A 60-year-old woman has been diagnosed with osteopenia and her physician recommends exercise to increase bone mineral density. Based on Wolff's Law, which type of exercise provides the greatest osteogenic stimulus?

A. Aquatic exercise performed in chest-deep water with buoyancy support reducing gravitational load

B. Recumbent cycling at very low intensity for 45 minutes three times per week

C. Ground-based, weight-bearing resistance exercises (squats, deadlifts, weighted lunges) that apply large compressive and impact forces directly to the axial and appendicular skeleton

D. Seated upper body machine exercises with very light resistance and 30 repetitions per set

31. A strength and conditioning specialist is evaluating two athletes who both have a back squat 1RM of 200 kg. Athlete A has a vertical jump of 68 cm while Athlete B has a vertical jump of 52 cm. Since both athletes have identical maximal strength, the 16 cm jump height difference is most likely explained by which physical quality?

A. Superior rate of force development in Athlete A — the ability to produce force more rapidly during the limited ground contact time of a vertical jump, translating equal maximal strength into greater explosive power

B. Greater absolute maximal strength in Athlete A despite the identical 1RM values

C. Superior aerobic capacity in Athlete A providing more oxidative energy for the jump

D. Greater flexibility in Athlete A allowing a deeper countermovement that increases contact time

32. During a heavy conventional deadlift, the moment arm of the external load relative to the lumbar spine is greatest at which point in the range of motion?

A. At full lockout when the torso is completely vertical and the bar is at hip height

B. During the initial pull from the floor when the bar is furthest forward from the spine

C. At no specific point because the moment arm remains constant throughout the entire lift

D. When the bar is approximately at knee height with the torso inclined forward, creating the maximum horizontal distance between the bar and the lumbar spine

33. The force-velocity relationship for concentric muscle actions describes an inverse relationship: as contraction velocity increases, the maximum force the muscle can produce decreases. This relationship has which direct implication for training program design?

A. Slow, heavy training and fast, light training produce identical adaptations regardless of load or velocity

B. To develop maximal strength, heavy loads at slow velocities are needed; to develop speed, light loads at high velocities are needed; to develop power, moderate loads at moderate-to-high velocities are needed — different regions of the curve require different loading strategies

C. All training should be performed at maximum velocity regardless of the load being used

D. The force-velocity relationship has no practical application to resistance training or program design

34. An athlete has been completely inactive for 6 weeks following surgery. Research on detraining indicates that different physiological qualities decline at different rates during inactivity. Which quality declines most rapidly?

A. Maximal strength, which drops by 50% within the first 72 hours of any inactivity period

B. Bone mineral density, which is lost completely within the first week of bed rest

C. Aerobic capacity (VO_2max), which shows measurable declines within 1 to 2 weeks with significant losses by 6 weeks of detraining

D. Flexibility, which is permanently eliminated after any period exceeding 48 hours without stretching

35. The length-tension relationship describes how the force a muscle can produce varies with sarcomere length due to changes in actin-myosin overlap. During a biceps curl, the sticking point typically occurs near the bottom of the range of motion because of which combined factor?

A. The biceps is in a lengthened position where actin-myosin overlap is suboptimal (fewer cross-bridges can form), and the moment arm of the resistance relative to the elbow is near its maximum (requiring greater torque from the muscle)

B. The biceps is at its shortest length where cross-bridge interference reduces force

C. Blood flow to the biceps is completely occluded at the bottom of the curl

D. The triceps are co-contracting at maximum force at the bottom position

36. Chronic endurance training increases capillary density in the trained muscles. This microvascular adaptation provides which specific benefit to exercise performance?

A. Decreased oxygen extraction at the tissue level due to reduced transit time through the capillary bed

B. Reduced blood flow to working muscles because more capillaries create greater vascular resistance

C. No measurable benefit to oxygen delivery or metabolic waste removal during exercise

D. Increased surface area for oxygen and nutrient exchange between the blood and the muscle fibers, and enhanced removal of metabolic waste products including CO_2, lactate, and heat

37. A strength and conditioning specialist measures an athlete's resting heart rate at 52 bpm and resting stroke volume at 100 mL/beat. The calculated resting cardiac output is approximately 5.2 L/min. During maximal exercise, this trained athlete's cardiac output increases to 30 L/min. The primary adaptation responsible for this high maximal cardiac output is which of the following?

A. Decreased blood volume that reduces the cardiac workload during maximal exercise

B. Increased maximal stroke volume from eccentric cardiac hypertrophy (enlarged left ventricular chamber), combined with increased blood volume and enhanced contractility, allowing more blood to be pumped per beat

C. A maximal heart rate that exceeds 250 bpm through sympathetic nervous system adaptation

D. Complete elimination of peripheral vascular resistance during maximal exercise

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

A. Increased blood viscosity that maintains pressure throughout the cardiac cycle

B. Decreased cardiac output during the relaxation phase of each heartbeat

C. Vasodilation in working muscles that reduces total peripheral resistance, counterbalancing the increased cardiac output and preventing diastolic pressure from rising

D. Vasoconstriction in working muscles that increases peripheral resistance proportionally

39. A female collegiate distance runner has been experiencing secondary amenorrhea (absence of menstruation) for 8 months. She trains 3 hours daily and estimates her caloric intake at approximately 1,300 calories per day. A DEXA scan reveals decreased bone mineral density in the lumbar spine. This clinical presentation is most consistent with which condition?

A. Relative Energy Deficiency in Sport (RED-S), characterized by the interrelationship between low energy availability, menstrual dysfunction, and decreased bone mineral density

B. Iron deficiency anemia from inadequate heme iron absorption during high-volume training

C. Normal physiological adaptation to high-volume endurance training in all female athletes

D. Vitamin C toxicity from excessive supplementation causing hormonal disruption

40. Cortisol is a glucocorticoid hormone released from the adrenal cortex in response to physical and psychological stress. Its acute metabolic actions during exercise include which of the following?

A. Directly stimulating muscle protein synthesis through activation of the mTOR signaling pathway

B. Enhancing glycogen synthesis by increasing glycogen synthase activity in skeletal muscle

C. Suppressing all lipolysis to prevent any fat utilization during exercise regardless of intensity

D. Stimulating protein degradation and gluconeogenesis — breaking down amino acids from muscle protein to provide substrates for glucose production during stress

41. The testosterone-to-cortisol (T:C) ratio is sometimes used as a biomarker of the balance between anabolic and catabolic processes. A declining T:C ratio over several weeks of training suggests which physiological state?

A. The athlete is in optimal condition with maximum anabolic signaling for adaptation

B. The recovery capacity may be insufficient relative to the training stress — a declining ratio suggests the catabolic environment may be outpacing the anabolic response, potentially indicating overreaching or overtraining

C. The athlete should immediately increase training volume and intensity to reverse the ratio

D. The T:C ratio has no relationship to recovery status or training adaptation

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

A. Directly activating satellite cells to initiate new muscle fiber formation through hyperplasia

B. Suppressing all glycogen synthesis to prevent excessive energy storage after exercise

C. Stimulating amino acid uptake into muscle cells and inhibiting protein degradation, creating an anabolic environment that supports recovery when combined with adequate protein and carbohydrate intake

D. Stimulating cortisol release from the adrenal cortex to enhance the catabolic recovery response

43. A strength and conditioning specialist is evaluating an athlete's training response after 16 weeks. The athlete has been following a well-periodized program with progressive overload, adequate nutrition, and 8+ hours of sleep nightly. Performance has improved steadily and the athlete reports feeling recovered between sessions. The hormonal profile shows stable testosterone with slightly decreased resting cortisol. This profile suggests which training status?

A. Successful adaptation — stable testosterone with decreased cortisol indicates a favorable anabolic-catabolic balance, consistent with the positive performance trend and subjective recovery reports

B. Overtraining syndrome requiring immediate cessation of all exercise

C. Hormonal disruption requiring pharmaceutical intervention

D. The hormonal data is irrelevant and provides no information about training status

44. Chronic heavy resistance training has been shown to increase androgen receptor density in skeletal muscle tissue. The practical significance of this adaptation for the strength and conditioning specialist is which of the following?

A. Androgen receptor upregulation has no effect on the muscle's response to circulating hormones

B. Increased receptor density eliminates the need for any post-exercise nutrition strategy

C. The adaptation converts all Type I fibers to Type IIx fibers through direct receptor stimulation

D. Enhanced androgen receptor density increases the muscle's sensitivity and responsiveness to circulating testosterone, potentially amplifying the anabolic signal even without changes in basal testosterone levels

45. An exercise physiologist is studying substrate utilization during a 3-hour cycling ride at 65% of VO_2max. The respiratory exchange ratio (RER) starts at 0.85 in the first 30 minutes and gradually decreases to 0.78 by the end of the ride. This progressive decrease in RER reflects which metabolic shift?

A. A progressive shift from carbohydrate oxidation toward increased fat oxidation as glycogen stores deplete during the prolonged ride

B. A shift toward exclusive protein oxidation as the primary fuel source during prolonged exercise

C. An increase in anaerobic metabolism as exercise duration extends beyond 2 hours

D. No meaningful change in substrate utilization because RER does not reflect fuel source

46. The Cori cycle is a metabolic pathway in which lactate produced by working muscles is transported to the liver, converted to glucose through gluconeogenesis, and released back into the blood for use by the muscles and brain. This cycle is particularly important during sustained exercise because it accomplishes which metabolic function?

A. Permanently removing lactate from the body as a toxic waste product that serves no metabolic purpose

B. Converting lactate directly into fatty acids for long-term energy storage in adipose tissue

C. Recycling lactate into glucose to help maintain blood glucose levels and provide continued substrate for working muscles and glucose-dependent tissues like the brain

D. Converting lactate into amino acids for muscle protein synthesis during exercise

47. A strength and conditioning specialist is explaining to an athlete why the work-to-rest ratio for phosphagen system development must include 3 to 5 minutes of rest between maximal efforts. The physiological justification for this extended rest is which of the following?

A. Phosphocreatine resynthesis requires 3 to 5 minutes for near-complete restoration, and without adequate PCr availability, subsequent sprint efforts will rely increasingly on glycolysis with its fatigue-inducing byproducts, reducing quality

B. The extended rest is needed exclusively for psychological recovery between maximal efforts

C. Heart rate must return to exactly 60 bpm before the next sprint effort can be initiated

D. The 3 to 5 minutes is required for complete glycogen resynthesis in all working muscles

48. A biomechanical analysis reveals that during a standing overhead press, the moment arm of the barbell relative to the shoulder joint changes throughout the range of motion. At which elbow position is the moment arm greatest, creating the sticking point?

A. At full elbow extension (lockout) where the bar is directly over the shoulder joint and the moment arm is minimal

B. At the starting position with the bar on the anterior deltoids before the press is initiated

C. At approximately 45 degrees of elbow flexion in the mid-range where the bar weight vector is farthest from the shoulder

D. At approximately 90 degrees of elbow flexion when the forearms are horizontal and the perpendicular distance from the barbell's gravitational force line to the shoulder joint axis is at or near maximum

49. A second-class lever has the resistance positioned between the fulcrum and the effort, with the effort arm always longer than the resistance arm. The standing calf raise is an example of a second-class lever in the human body. This lever arrangement favors which mechanical outcome?

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

B. Force production because the longer effort arm provides a mechanical advantage greater than one, meaning the muscle can produce movement against a greater resistance than a third-class lever arrangement

C. Neither force nor speed because second-class levers have a mechanical advantage of exactly zero

D. Equal emphasis on force and speed because the effort and resistance arms are always identical

50. An athlete's passive shoulder flexion ROM is 175 degrees when an external force is applied, but their active shoulder flexion is only 160 degrees using their own muscular effort. This 15-degree difference between passive and active ROM at the shoulder is explained by which factor?

A. The athlete has a complete rotator cuff tear that prevents all active motion beyond 160 degrees

B. The goniometer used for the passive measurement was calibrated incorrectly by 15 degrees

C. Passive ROM exceeds active ROM because external force can move the joint beyond the limit of the individual's voluntary muscular effort — the difference reflects the neuromuscular and motor control limits of active motion

D. Active ROM should always be greater than passive ROM in all healthy joints

51. Muscle spindles are proprioceptors located within the muscle belly that detect changes in muscle length and the rate of length change. During plyometric training, the rapid eccentric stretch of the quadriceps during landing activates the muscle spindles, which produce a reflexive response that enhances the subsequent concentric contraction. This reflex is called which of the following?

A. The stretch reflex (myotatic reflex), which is a monosynaptic reflex arc producing a rapid protective contraction of the stretched muscle — in plyometrics, this reflex augments concentric force production during the SSC

B. The withdrawal reflex, which pulls the limb away from a painful stimulus

C. Autogenic inhibition, which reduces muscle tension to prevent tendon damage

D. The crossed-extensor reflex, which extends the opposite limb during single-leg stance

52. A novice athlete begins a resistance training program and achieves the following improvements over 16 weeks: squat 1RM increases 55% (Weeks 1–8 primarily neural), with ultrasound showing 15% quadriceps hypertrophy (Weeks 9–16 primarily structural). After 16 weeks, the rate of improvement slows despite continued training. This deceleration is explained by which training principle?

A. The athlete has reached their absolute genetic maximum and can never improve further

B. The principle of reversibility causing detraining despite continued consistent training

C. The deceleration is caused by a nutritional deficiency that only manifests after exactly 16 weeks

D. The law of diminishing returns — the easily accessible neural and structural adaptations have been captured, and progressively greater training specificity, variation, and programming sophistication are required for smaller incremental gains

SPORT PSYCHOLOGY (Questions 53–75)

53. An athlete preparing for an Olympic qualifying competition reports two distinct categories of pre-competition symptoms. The first includes racing thoughts, worry about making mistakes, and fear of disappointing their coaching staff. The second includes muscle tension in the shoulders and neck, elevated resting heart rate, and sweaty palms. The first group of symptoms is classified as which type of anxiety?

A. Somatic anxiety characterized by physiological activation and physical tension symptoms

B. Cognitive anxiety characterized by negative thought patterns, worry, and fear of failure

C. Trait anxiety that is a permanent personality disposition unresponsive to intervention

D. Facilitative arousal that enhances performance through increased physiological readiness

54. According to the inverted-U hypothesis, an Olympic archer preparing for a precision shot requiring steady hands, focused concentration, and fine motor control should aim for which arousal level?

A. Very high arousal to maximize physiological activation and muscle recruitment for the shot

B. Moderate arousal identical to the optimal level for a maximal deadlift or football tackle

C. Relatively low arousal because excessive activation causes tremor, attentional narrowing, and impaired fine motor control that degrade precision shooting accuracy

D. Arousal level is irrelevant because the inverted-U hypothesis applies only to team sports

55. A strength and conditioning specialist designs a 20-week training program for a competitive weightlifter. According to goal-setting research, the most effective approach for maintaining adherence and directing daily effort throughout this extended program is to use which combination of goal types?

A. Only an outcome goal such as "Win the national championship" with no intermediate benchmarks

B. Only process goals with no long-term direction or measurable performance benchmarks

C. A hierarchical combination of outcome goals (long-term competitive targets), performance goals (specific measurable benchmarks), and process goals (daily controllable behaviors)

D. No goals of any type because goal-setting has been proven to decrease athletic motivation

56. Self-efficacy, as defined by Albert Bandura, differs from general self-confidence in which specific way?

A. Self-efficacy is task-specific and situation-specific — high confidence in one task does not automatically transfer to all other tasks

B. Self-efficacy is a global personality trait that applies equally to every situation and task

C. Self-efficacy is determined exclusively by genetics and cannot change with experience or training

D. Self-efficacy and general self-confidence are identical concepts with no meaningful distinction

57. An athlete performs exceptionally well during practice but consistently underperforms during high-stakes competitions. The athlete reports intense pre-competition worry, negative self-talk such as "I'm going to choke," and difficulty focusing on the task. This pattern is most consistent with which psychological phenomenon?

A. Social facilitation where spectators always enhance competitive performance

B. Choking under pressure — excessive cognitive anxiety disrupts the automatic execution of well-learned motor skills in high-stakes situations

C. Optimal arousal producing the athlete's best possible performance under competitive conditions

D. A permanent performance ceiling that cannot be addressed through any intervention

58. A sport psychologist recommends that an athlete experiencing somatic anxiety (muscle tension, elevated heart rate, rapid breathing) before competition use which type of intervention?

A. Cognitive restructuring to replace negative thought patterns with positive affirmations

B. Goal-setting worksheets to redirect attention from the outcome to process objectives

C. Physical relaxation techniques such as progressive muscle relaxation and diaphragmatic breathing that directly target the physiological symptoms

D. Imagery focused on worst-case scenario rehearsal to prepare for potential competitive failures

59. Mental imagery is most effective for performance enhancement when it engages multiple sensory modalities simultaneously. An effective mental rehearsal for a basketball free throw should include which combination of sensory components?

A. Only the visual image of the ball going through the hoop with no other sensory engagement

B. Only the kinesthetic feel of the shooting motion without any visual or emotional components

C. Only the auditory sound of the crowd without any visual or kinesthetic imagery

D. Visual (seeing the ball trajectory), kinesthetic (feeling the shooting motion), auditory (hearing the ball swish through the net), and emotional (experiencing the confidence of a successful shot) components

60. In Fitts and Posner's three-stage model of motor learning, an athlete in the associative stage demonstrates which performance characteristics that distinguish this stage from the cognitive stage?

A. Smaller, less frequent errors with developing ability to self-detect and self-correct some mistakes — the athlete understands the movement pattern and is refining it through practice

B. Completely automatic execution with no conscious attention needed for technique

C. Inability to perform the movement under any circumstances even with coaching guidance

D. Large, frequent errors with heavy dependence on verbal instruction identical to the cognitive stage

61. The contextual interference effect predicts that random practice (intermixing multiple skills within a session) produces which specific learning outcome compared to blocked practice?

A. Faster initial improvement and superior long-term retention simultaneously in all cases

B. Slower initial improvement but significantly better long-term retention and transfer — the constant task-switching forces deeper cognitive processing that builds more robust motor representations

C. Identical outcomes to blocked practice because practice structure has no effect on learning

D. Faster initial improvement with inferior long-term retention identical to blocked practice

62. Research on feedback frequency has established the guidance hypothesis. According to this principle, providing extrinsic feedback after every single repetition during a training session produces which long-term learning consequence?

A. Optimal long-term retention because maximum feedback always maximizes learning

B. No effect because feedback frequency is irrelevant to motor skill acquisition

C. Accelerated learning that persists indefinitely without any negative consequence

D. Impaired long-term learning because the athlete develops dependency on external correction rather than developing independent error-detection capabilities

63. A strength and conditioning specialist tells an athlete: "Your front knee collapsed inward during that lunge." This feedback provides information about the quality of the movement pattern itself. This type of feedback is classified as which of the following?

A. Knowledge of results (KR) providing information about the outcome of the movement

B. Intrinsic feedback based on the athlete's own sensory perception during the movement

C. Knowledge of performance (KP) — information about the technique and movement quality

D. Motivational feedback designed exclusively to increase the athlete's effort and intensity

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

A. Memory consolidation during the rest intervals — the neurological process of stabilizing and transferring motor memories from short-term to long-term storage

B. Distributed practice eliminates all performance errors so that only perfect repetitions are encoded

C. The rest intervals allow complete glycogen resynthesis that improves motor cortex function

D. Massed practice produces absolutely no learning under any circumstances or conditions

65. Transfer of training is highest when the practiced skill and the target skill share common features. A strength and conditioning specialist prescribes front squats to improve an athlete's power clean receiving position. This exercise selection exploits which type of transfer?

A. Negative transfer because the front squat conflicts with the power clean rack position

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

C. Zero transfer because no exercise can affect the learning of any other exercise

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

66. An athlete who has been progressively withdrawn, reports persistent loss of motivation, expresses feeling "trapped" in their sport, and demonstrates emotional exhaustion over several weeks is most likely experiencing which psychological condition?

A. Optimal psychological readiness for peak competitive performance

B. Normal day-to-day mood fluctuation that will resolve spontaneously within 24 hours

C. Acute pre-competition anxiety that disappears immediately after the competitive event

D. Athletic burnout characterized by emotional exhaustion, depersonalization, and reduced sense of accomplishment

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

A. Recognizing these as potential warning signs of depression and recommending that the parents seek evaluation from a qualified mental health professional

B. Designing a more challenging training program to build confidence through physical accomplishment

C. Increasing the athlete's competitive schedule to provide more opportunities for success and recognition

D. Ignoring the concerns because mood changes are a completely normal part of adolescent development

68. A collegiate wrestler displays warning signs of disordered eating: extreme pre-weigh-in weight manipulation, avoidance of team meals, excessive exercise beyond the training plan, and preoccupation with body weight. According to scope of practice guidelines, the strength and conditioning specialist should do which of the following?

A. Prescribe a detailed meal plan to correct the wrestler's nutritional deficiencies and restore body weight

B. Conduct frequent body composition testing to monitor the wrestler's weight more closely

C. Refer the athlete to a qualified healthcare professional for evaluation and treatment — diagnosing and treating eating disorders is outside the CSCS scope of practice

D. Ignore the signs because weight manipulation is a normal and acceptable part of wrestling culture

69. Self-determination theory identifies three basic psychological needs that support intrinsic motivation: autonomy, competence, and relatedness. A training environment that removes all athlete input, provides no positive feedback, and isolates underperformers would most directly undermine which motivational outcome?

A. Exclusively extrinsic motivation, which would be enhanced by the authoritarian environment

B. Intrinsic motivation — because all three basic needs (autonomy through input, competence through feedback, relatedness through inclusion) are simultaneously violated

C. Only relatedness, with no effect on autonomy or competence

D. No motivational outcome because self-determination theory does not apply to athletic settings

70. Research on Relative Energy Deficiency in Sport (RED-S) has established that chronic low energy availability produces health and performance consequences in both male and female athletes. In male athletes, chronic energy deficiency can produce which specific consequences?

A. Enhanced performance from the metabolic efficiency gained through chronic energy restriction

B. Increased testosterone production from the adaptive stress response to caloric deficit

C. No consequences because RED-S exclusively affects female athletes

D. Suppressed testosterone, decreased bone mineral density, impaired immune function, and declining athletic performance

71. An athlete who successfully squats 180 kg for the first time reports significantly increased confidence about attempting 185 kg at the next session. According to Bandura's self-efficacy theory, this confidence increase is primarily driven by which source?

A. Past performance accomplishment — the direct mastery experience of successfully completing the 180 kg squat, which is the most powerful source of self-efficacy

B. Vicarious experience from watching a training partner perform a heavier lift

C. Verbal persuasion from the coach encouraging the attempt

D. Physiological state interpretation based on the absence of pre-lift anxiety symptoms

72. In Nideffer's model of attentional focus, a basketball point guard surveying the entire court to identify defensive coverage and open teammates before making a pass is using which type of attention?

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

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

C. Broad-external focus — scanning a wide field of external stimuli to perceive multiple players and positions simultaneously

D. Broad-internal focus analyzing personal strategy without any environmental awareness

73. A motor program theory concept holds that a generalized motor program (GMP) contains invariant features that remain constant and variable parameters that can be adjusted for different situations. When a pitcher throws a fastball and then a changeup using the same arm action pattern but at different speeds, the variable parameter being adjusted is which of the following?

A. The relative timing and sequencing of muscle activations, which completely change between pitch types

B. The fundamental spatial pattern of the throwing motion, which is restructured for each pitch

C. Nothing changes because the GMP is completely fixed and cannot be modified under any condition

D. The absolute speed and force of the movement execution, while the invariant features (relative timing, relative force proportions, spatial pattern) remain constant

74. An athlete returning from ACL surgery reports significant fear of re-injury during cutting and pivoting drills despite full physical clearance from the medical team. The strength and conditioning specialist's most appropriate response includes which combination?

A. Immediately returning the athlete to full-contact competition to force them past the fear

B. Permanently eliminating all cutting and pivoting movements from the athlete's program

C. Telling the athlete that psychological concerns are irrelevant and they should focus only on physical readiness

D. Gradually reintroducing sport-specific movements at progressive intensities while facilitating referral to a sport psychologist for addressing the fear through evidence-based psychological interventions

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

A. Longer recovery times and higher re-injury rates — psychological factors significantly influence rehabilitation outcomes and return-to-play success

B. Identical rehabilitation outcomes because psychological state has no effect on physical recovery

C. Faster recovery times because distress motivates harder rehabilitation effort

D. No variation in outcomes because all athletes respond identically to injury

NUTRITION (Questions 76–95)

76. A 95 kg strength athlete requires protein intake at the upper end of evidence-based recommendations to support heavy resistance training. At 2.2 g/kg/day, the daily protein target is which of the following?

A. 76 grams per day based on the general population RDA of 0.8 g/kg/day

B. 209 grams per day calculated as 95 kg × 2.2 g/kg/day

C. 475 grams per day based on an exaggerated recommendation of 5.0 g/kg/day

D. 38 grams per day consumed exclusively in a single post-workout meal

77. Post-exercise protein intake of 20 to 40 grams of high-quality protein maximizes the muscle protein synthetic response. Which specific amino acid within this protein serving is considered the primary trigger for activating the mTOR signaling pathway?

A. Glutamine, which is the most abundant amino acid in the body

B. Glycine, which is the smallest amino acid with the fastest absorption rate

C. Alanine, which is the primary gluconeogenic amino acid used for glucose production

D. Leucine, which is the branched-chain amino acid identified as the key trigger for mTOR activation and the initiation of muscle protein synthesis

78. An athlete following a very low-fat diet (less than 15% of total calories from fat) for 4 months reports declining energy levels and poor recovery. Blood work reveals suppressed testosterone. The most likely nutritional explanation for these findings is which of the following?

A. Excessive protein intake causing renal overload and secondary hormonal disruption

B. Inadequate water intake causing chronic dehydration that suppresses all hormonal production

C. Inadequate dietary fat intake impairing steroid hormone production (testosterone requires cholesterol as a precursor) and reducing absorption of fat-soluble vitamins (A, D, E, K)

D. Excessive carbohydrate consumption causing permanent insulin resistance and hormonal disruption

79. During a marathon on a hot, humid day, an athlete consumes only plain water at a rate of 2.5 liters per hour for 4 hours without any sodium replacement. After the race, the athlete is confused and disoriented. Emergency medical personnel diagnose exercise-associated hyponatremia. This condition resulted from which mechanism?

A. Dilution of blood sodium concentration by the excessive plain water intake relative to the sodium lost through sweat, reducing serum sodium below safe levels

B. Excessive sodium concentration from inadequate fluid intake causing dangerous hypernatremia

C. Metabolic alkalosis from the elevated pH of the consumed plain water during the race

D. Rhabdomyolysis from the mechanical stress of 4 hours of continuous running

80. Creatine monohydrate supplementation increases intramuscular phosphocreatine stores. The standard loading protocol (20 g/day for 5–7 days) achieves rapid saturation. An athlete who prefers to skip the loading phase can use the maintenance dose of 3 to 5 grams per day, achieving full saturation in approximately how long?

A. 24 to 48 hours of consistent supplementation at the maintenance dose

B. Approximately 28 days of consistent daily supplementation at 3 to 5 grams per day

C. Full saturation is impossible without completing the loading phase first

D. 6 to 12 months of supplementation regardless of the daily dose consumed

81. Caffeine enhances exercise performance at doses of 3 to 6 mg/kg consumed 30 to 60 minutes before exercise. A 75 kg athlete wanting the lower end of the effective ergogenic dose should consume approximately how many milligrams?

A. 750 mg, which far exceeds the recommended range and increases side effect risk

B. 15 mg, which is far below the threshold for any measurable ergogenic effect

C. The athlete should consume no caffeine because it has no ergogenic properties

D. 225 mg (75 kg × 3 mg/kg), representing the lower end of the effective ergogenic dose range

82. Beta-alanine supplementation increases intramuscular carnosine concentrations. Carnosine functions as an intracellular hydrogen ion buffer during high-intensity exercise. This buffering effect is most beneficial for performance in activities lasting which duration?

A. Less than 5 seconds where the phosphagen system provides all required ATP

B. Longer than 60 minutes where fat oxidation is the predominant energy pathway

C. 1 to 4 minutes where hydrogen ion accumulation from glycolysis is the primary performance limiter

D. During complete rest when no metabolic byproducts are being produced

83. An athlete subject to WADA anti-doping regulations asks which supplement certification minimizes the risk of inadvertent positive drug tests from product contamination. The strength and conditioning specialist should recommend which certification?

A. NSF Certified for Sport or Informed Sport, which independently test products for banned substances, verify label accuracy, and screen for undeclared ingredients

B. USDA Organic certification, which guarantees complete absence of all banned substances

C. FDA pharmaceutical approval, which is required for all dietary supplements before sale

D. ISO 9001 manufacturing quality certification, which verifies banned substance testing

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

A. The general population RDA of 0.8 g/kg/day, sufficient for all populations during caloric restriction

B. 2.0 to 2.4 g/kg/day at the upper end of recommendations to maximize lean mass preservation during energy restriction

C. Less than 0.5 g/kg/day to minimize total caloric intake as aggressively as possible

D. No protein because eliminating it entirely accelerates fat loss without affecting muscle mass

85. Sodium bicarbonate is an extracellular buffer that enhances performance during high-intensity glycolytic exercise. The typical effective dose is 0.2 to 0.3 g/kg consumed 60 to 90 minutes before exercise. The most common side effect limiting tolerability is which of the following?

A. Permanent liver damage from sodium bicarbonate toxicity at any dose

B. Dangerous cardiac arrhythmias requiring immediate medical intervention

C. Complete suppression of all anaerobic energy pathways for 24 hours post-ingestion

D. Gastrointestinal distress including nausea, bloating, cramping, and diarrhea

86. An endurance athlete training at high volume requires carbohydrate at the upper end of recommendations. For an 80 kg athlete at 10 g/kg/day, the daily carbohydrate target is which of the following?

A. 80 grams per day based on a very low carbohydrate restriction approach

B. 400 grams per day based on a moderate recommendation of 5 g/kg/day

C. 800 grams per day calculated as 80 kg × 10 g/kg/day

D. 1,600 grams per day calculated by doubling the upper range recommendation

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

A. Impaired muscle function, compromised immune competence, and elevated risk of stress fractures with decreased bone mineral density

B. Excessive muscle hypertrophy that exceeds all desired training goals

C. Enhanced performance from the metabolic efficiency of vitamin D-depleted muscle tissue

D. No consequences because vitamin D serves no role in muscle, bone, or immune function

88. Iron deficiency is common among female athletes and endurance athletes. Consuming vitamin C alongside plant-based (non-heme) iron sources enhances absorption through which mechanism?

A. Vitamin C inhibits all iron absorption as a protective mechanism against iron overload

B. Vitamin C converts ferric iron (Fe^{3+}) to the more bioavailable ferrous form (Fe^{2+}), enhancing intestinal absorption of non-heme iron

C. Vitamin C has no interaction with iron metabolism under any circumstance

D. Vitamin C enhances heme iron absorption exclusively while blocking all non-heme iron uptake

89. Post-exercise carbohydrate intake is most critical for rapid glycogen replenishment when two training sessions are scheduled within 8 hours. The recommended intake within the first 30 minutes is which of the following?

A. No carbohydrate should be consumed for 12 hours to promote fat adaptation

B. 0.1 g/kg — a minimal amount to avoid any insulin response after the session

C. Only protein with zero carbohydrate because glycogen synthesis occurs independently of carbohydrate

D. 1.0 to 1.5 g/kg of carbohydrate to maximize glycogen synthase activity during the window of highest enzyme sensitivity

90. A plant-based athlete asks the strength and conditioning specialist how to ensure adequate essential amino acid intake. The specialist should advise which strategy?

A. Plant-based diets can never provide adequate protein for athletic performance under any strategy

B. Only soy protein is acceptable because all other plant sources provide zero amino acids

C. Consuming a variety of complementary plant protein sources throughout the day ensures all essential amino acids are provided in adequate quantities

D. Supplementation with 100 grams of isolated BCAAs daily is required to overcome plant protein deficiency

91. Consuming 30 to 40 grams of casein protein before sleep has been shown to provide which specific benefit for overnight recovery?

A. Sustained amino acid delivery throughout the overnight fasting period, supporting muscle protein synthesis during sleep when no other protein is consumed

B. Immediate gastric emptying identical to whey protein with no difference in absorption rate

C. Complete suppression of all catabolic hormones for 24 hours following consumption

D. No benefit because protein consumed before sleep is entirely wasted and provides no recovery advantage

92. The glycemic index (GI) ranks carbohydrate foods by their blood glucose response after ingestion. High-GI foods are most appropriately consumed at which time relative to exercise?

A. Only at breakfast regardless of training schedule or nutritional goals

B. During and immediately after exercise when rapid glucose delivery and glycogen replenishment are the priority

C. Exclusively before sleep to maximize overnight insulin secretion

D. High-GI foods should never be consumed by any athlete under any circumstances

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

A. Glutamine has the strongest evidence of any supplement for muscle hypertrophy, surpassing creatine

B. Glutamine at any dose permanently elevates testosterone in all athletic populations

C. Glutamine is the only supplement approved by all anti-doping agencies worldwide

D. Limited — glutamine supplementation has not demonstrated strong evidence for muscle growth in athletes with adequate protein intake and is not classified among supplements with robust ergogenic evidence

94. Adequate dietary fat (20–35% of total calories) is recommended for athletes because fat serves which essential physiological functions?

A. Fat has no physiological function and can be completely eliminated from any diet

B. Fat is the exclusive fuel for the phosphagen energy system during maximal sprinting

C. Steroid hormone production (requiring cholesterol as a precursor), fat-soluble vitamin absorption (A, D, E, K), cell membrane integrity, and provision of essential fatty acids that the body cannot synthesize

D. Fat directly stimulates Type IIx fiber hyperplasia independent of any training stimulus

95. An athlete preparing for a team sport match should maintain hydration during competition. The general guideline for fluid intake during exercise to prevent body weight loss exceeding 2% is which of the following?

A. Approximately 200 to 300 mL every 15 to 20 minutes, adjusted based on individual sweat rate, environmental conditions, and sport-specific opportunities for fluid intake

B. No fluid intake during any competitive event because drinking impairs performance

C. A minimum of 4 liters consumed in a single bolus at halftime regardless of thirst

D. Only caffeinated energy drinks because they simultaneously enhance hydration and performance

SECTION 2 — PRACTICAL/APPLIED

125 Questions | 2.5 Hours Recommended

EXERCISE TECHNIQUE (Questions 96–140)

96. A strength and conditioning specialist evaluates a group of freshman athletes before beginning a resistance training program. Before performing any loaded barbell exercise, each athlete should first demonstrate competency in which movement?

A. A 1RM back squat at the heaviest possible weight to establish baseline maximal strength

B. A barbell overhead press at 80% of estimated 1RM to assess shoulder stability under load

C. A weighted depth jump from a 42-inch box to evaluate reactive strength and landing mechanics

D. An unloaded bodyweight squat to assess mobility (ankle, hip, thoracic), motor control (knee tracking, spinal neutrality), and basic movement competency

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

A. Excessive hip flexion range of motion causing the pelvis to anteriorly tilt beyond normal limits

B. Insufficient ankle dorsiflexion mobility preventing the tibia from translating forward adequately to maintain balance with the heels grounded

C. Superior quadriceps strength that overpowers the posterior chain during the descent

D. Excessive thoracic extension mobility pushing the torso too far backward

98. An athlete performing the conventional deadlift is observed with the bar drifting 5 inches forward of the shins during the initial pull from the floor. The primary biomechanical consequence of this forward bar drift is which of the following?

A. Decreased torque demand on the lumbar spine because the bar is further from the body

B. Improved mechanical advantage for the quadriceps during the initial knee extension

C. Increased moment arm on the lumbar spine, dramatically increasing the flexion torque that the erector spinae must resist and elevating the risk of lumbar injury

D. No biomechanical consequence because bar path does not affect spinal loading

99. A strength and conditioning specialist is teaching the barbell bench press. The specialist requires all athletes to use a closed grip with thumbs wrapped around the bar. This safety requirement prevents which specific hazard?

A. The bar from rolling out of the hands onto the chest, neck, or face — a potentially catastrophic event that can occur with an open (false) grip

B. The bar from spinning on its axis during pressing movements

C. Excessive triceps activation that could lead to elbow tendinopathy

D. The development of forearm imbalances from asymmetric grip pressure

100. During a standing barbell overhead press, an athlete compensates for excessive load by arching the lower back into hyperextension. This technique error creates which primary safety concern?

A. Enhanced anterior deltoid activation that improves pressing mechanics

B. Improved spinal stability because lumbar extension under load is the preferred technique

C. No safety concern because lumbar position is irrelevant during overhead pressing

D. Compressive and shear forces on the lumbar spine that increase injury risk, while simultaneously shifting the exercise toward an incline press pattern

101. The NSCA recommends a top-down teaching progression for the power clean. The first exercise in this progression establishes the receiving position before any pulling phases are introduced. Which exercise is taught first?

A. Full squat clean from the floor at 85% of estimated 1RM to test the athlete's natural ability

B. The front squat, which develops the front rack position, comfort with the bar on the anterior deltoids, and the receiving posture

C. The clean pull from the floor without any catch to develop pulling strength independently

D. The hang power clean from above the knee at near-maximal loads

102. During the second pull of the power clean, the athlete should explosively extend the hips, knees, and ankles (triple extension) while keeping the arms straight. An athlete who bends the elbows prematurely during the second pull is committing which error?

A. Using the preferred technique variation for all loads above 60% of 1RM

B. The correct arm action for maximizing bar velocity during Olympic lifting

C. Pulling with the arms rather than driving through triple extension, which reduces the contribution of the more powerful hip extensors and limits the weight that can be successfully cleaned

D. The appropriate technique for converting the power clean into a strict barbell curl variation

103. An athlete performing depth jumps demonstrates ground contact times increasing from 170 ms to 360 ms by the sixth repetition with declining rebound jump height. The strength and conditioning specialist should respond by doing which of the following?

A. Increasing the box height to provide greater eccentric overload for faster adaptation

B. Adding ankle weights to increase the training stimulus on subsequent repetitions

C. Continuing to 15 repetitions because plyometric training requires maximum volume for adaptation

D. Terminating the exercise immediately because the athlete is fatiguing, ground contact has doubled, and SSC benefit is lost — continuing trains degraded movement patterns

104. A strength and conditioning specialist is programming the first plyometric session for a team of novice athletes who have completed 10 weeks of resistance training. Which exercise intensity and volume combination is most appropriate?

A. Low-to-moderate intensity exercises (squat jumps, countermovement jumps, box jumps stepping down) at 80 to 100 foot contacts per session

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

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

D. Weighted jump squats at 60% of 1RM for 300 foot contacts per session

105. When spotting a barbell back squat with a single spotter, the spotter should position themselves behind the athlete and provide assistance at which location?

A. Directly on the barbell at each end to lift the weight off the athlete's back

B. Near the athlete's torso with arms extending under the armpits — assisting the athlete upward without gripping the bar

C. On the athlete's hips to push them straight upward during a failed repetition

D. On the athlete's shoulders to stabilize the upper body throughout the entire set

106. The Valsalva maneuver produces extreme blood pressure spikes during heavy lifting. This technique is appropriate for which specific population and exercise context?

A. All populations regardless of cardiovascular status during every exercise at all intensities

B. Only during light isolation exercises such as biceps curls at 30% of 1RM

C. Healthy, trained athletes performing heavy compound lifts (near-maximal squats, deadlifts, presses) where maximal intra-abdominal pressure provides essential spinal stabilization

D. Individuals with uncontrolled hypertension performing any type of resistance exercise

107. An athlete performing barbell bent-over rows rounds the thoracic and lumbar spine significantly while using body momentum to jerk the weight upward. The strength and conditioning specialist should respond by doing which of the following?

A. Encouraging the momentum because it allows the use of heavier loads for greater overload

B. Adding more weight because the athlete clearly has additional capacity

C. Switching permanently to a different exercise because rows cannot be performed safely

D. Terminating the set, reducing the load, and cueing a rigid neutral spine with the pull initiated by scapular retraction rather than torso jerking

108. A strength and conditioning specialist is designing core training for a collegiate baseball pitcher who needs rotational power for throwing and anti-rotation stability for deceleration. Which exercise combination addresses both needs?

A. Medicine ball rotational throws for explosive power and Pallof press variations for anti-rotation stability

B. Only weighted sit-ups because trunk flexion is the sole core demand for pitchers

C. Only isometric plank holds for 5 minutes because pitchers need endurance exclusively

D. Heavy Russian twists at maximal velocity as the only core exercise needed

109. Anti-extension core exercises such as the ab wheel rollout and front plank train the core musculature to resist which specific spinal movement?

A. Trunk rotation in the transverse plane during throwing and striking activities

B. Lumbar hyperextension — resisting the tendency for the lumbar spine to arch as gravity or external load pulls it into extension

C. Lateral flexion of the trunk in the frontal plane during side-stepping movements

D. Trunk flexion in the sagittal plane as occurs during crunch and sit-up exercises

110. During the acceleration phase of a sprint (first 10–30 meters), the athlete should be in a pronounced forward lean. An athlete running fully upright from the first step experiences which consequence?

A. Enhanced acceleration because the upright position maximizes stride frequency from step one

B. No effect because body position has no relationship to sprint acceleration mechanics

C. Reduced horizontal ground reaction force production, impairing acceleration because the upright position directs forces too vertically

D. Improved top-end speed that compensates for any loss of initial acceleration ability

111. The pro agility shuttle (5-10-5) technically assesses change-of-direction speed rather than true agility. True agility includes which additional component?

A. A physical deceleration and reacceleration component during the directional changes

B. A timing mechanism to quantify each individual direction change independently

C. Multiple direction changes exceeding two within a single test administration

D. A reactive perceptual-cognitive decision-making component requiring response to unpredictable stimuli

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

A. Dynamic stretching increases ROM while activating the neuromuscular system, whereas static stretching before explosive activity acutely reduces force production, power, and sprint performance

B. Static stretching permanently destroys muscle fibers making them unable to contract

C. Dynamic and static stretching produce identical effects on all subsequent performance measures

D. Dynamic stretching provides no range of motion benefit and serves only as a cardiovascular warmup

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

A. Foam rolling permanently restructures fascial tissue after a single 30-second application

B. Foam rolling produces identical performance decrements to 60-second static stretching holds

C. Increased range of motion without the acute decrements in force production and power associated with static stretching

D. Foam rolling reduces range of motion compared to performing no pre-training mobility work

114. A complete warmup protocol before a heavy resistance training session should progress in which sequence?

A. Heavy working sets → static stretching → cooldown jog → foam rolling

B. General warmup (low-intensity whole-body activity) → dynamic stretching → movement preparation → specific warmup with progressive loading in the training exercises

C. Static stretching → maximal-effort lifts → dynamic stretching → isolation exercises

D. No warmup is necessary because resistance training itself serves as the warmup

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

A. Accelerated muscle protein synthesis and enhanced hypertrophy gains beyond normal

B. Improved neural adaptation and increased maximal voluntary contraction force

C. Enhanced tendon remodeling and increased connective tissue strength

D. Blunted inflammatory signaling that is necessary for muscle hypertrophy and strength adaptation

116. The single most important recovery practices — more important than any external modality — are which of the following?

A. Adequate sleep of 7 to 10 hours nightly combined with appropriate post-exercise nutrition (protein for repair, carbohydrate for glycogen replenishment)

B. Pneumatic compression boots worn for 60 minutes after every training session

C. Cryotherapy chamber sessions at minus 110°C twice daily regardless of training content

D. Transcutaneous electrical nerve stimulation applied to all major muscle groups nightly

117. A strength and conditioning specialist is designing conditioning for a basketball team. Games involve 48 minutes with repeated sprints, jumps, and direction changes. Which comprehensive conditioning approach best prepares the team?

A. Exclusively long-distance running at 60% of maximum heart rate five days per week

B. Only heavy resistance training with no conditioning component of any type

C. A combination of aerobic base training (tempo runs, fartlek), anaerobic interval training (court-length sprints with sport-specific rest), and reactive agility conditioning

D. Exclusively static stretching for 60 minutes per session

118. The aerobic system's most important contribution to team sport athletes who perform repeated high-intensity efforts during competition is which of the following?

A. Directly powering each maximal sprint through aerobic ATP production

B. Recovery capacity — the aerobic system replenishes phosphocreatine, clears metabolic byproducts, and restores homeostasis between high-intensity bouts, enabling sustained performance

C. Eliminating the need for glycolytic energy production during all team sport activities

D. No relevance because team sports are entirely anaerobic with zero aerobic component

119. Interval training for a football defensive back (repeated 4–6 second sprints with 25–40 seconds rest) should use which work-to-rest ratio?

A. 1:1 ratio targeting the oxidative energy system with equal work and rest durations

B. 1:3 ratio targeting the glycolytic system with moderate recovery between efforts

C. 1:20 ratio with 2 to 3 minutes of complete rest between each sprint effort

D. 1:5 to 1:7 ratio targeting the phosphagen system with near-complete PCr recovery

120. Active recovery — low-intensity exercise below 50% of maximum heart rate performed the day after intense training — provides which primary proposed benefit?

A. Promotes blood flow to recovering tissues and facilitates metabolic waste removal

B. Completely eliminates all muscle soreness within 15 minutes of initiation

C. Produces the same adaptive training stimulus as a high-intensity training session

D. Replaces the need for sleep by providing identical recovery benefits in less time

121. When performing a front squat, maintaining a high elbow position throughout the movement is critical. If the elbows drop during the descent, the immediate consequence is which of the following?

A. Improved quadriceps activation from the altered torso angle and bar position

B. Enhanced thoracic extension and reduced demand on the upper back musculature

C. The bar rolls forward off the anterior deltoids, creating dangerous loss of control and excessive wrist and elbow stress

D. Increased biceps activation that helps support the barbell in the rack position

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

A. Greater compressive force on the patellofemoral joint for cartilage strengthening

B. Reduced shear force on the front knee because stepping backward eliminates the eccentric deceleration demand on the front leg

C. Increased forward knee translation that loads the quadriceps tendon more aggressively

D. Elimination of all eccentric muscle action throughout the entire lowering phase

123. An athlete performing a Bulgarian split squat (rear foot elevated) reports excessive strain on the front knee. Which technique modification most likely reduces anterior knee stress?

A. Moving the front foot closer to the bench to maximize forward knee translation

B. Raising the rear foot to a higher bench to increase the range of motion at the front knee

C. Adding forward torso lean to shift the center of gravity directly over the front knee joint

D. Moving the front foot further from the bench to create a more vertical shin angle, shifting emphasis to the hip extensors

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

A. Reduced moment arm on the lumbar spine because the load is centered closer to the body's center of mass, decreasing spinal loading

B. Greater moment arm increasing the training stimulus for the erector spinae

C. Identical biomechanics to the conventional deadlift with no meaningful difference

D. Increased grip demand because hex bar handles are always thicker than standard barbells

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

A. Directly on the dumbbells themselves to guide their movement path

B. At the elbows to create a fulcrum for additional pressing leverage

C. At the wrists near the athlete's hands, not at the elbows or at the dumbbells

D. At the upper arms near the shoulder to stabilize the glenohumeral joint

126. Resistance bands combined with barbells create accommodating resistance. During a banded squat, resistance is lowest at the bottom and highest at the top. This loading profile challenges the athlete in which way?

A. By eliminating all resistance at the bottom so the athlete can rest during the most difficult position

B. By providing maximum resistance in the mechanically strongest position (top) where free weights alone become relatively easy, training force production through the full ROM

C. By providing constant resistance identical to free weights at every point in the range

D. By creating maximum resistance at the bottom where the athlete is in the weakest mechanical position

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

A. A deliberate 5-second pause between catching and throwing for maximum isometric development

B. Slow, controlled tempo during both catching and throwing for maximum time under tension

C. Maximum weight possible to develop maximal absolute strength rather than reactive power

D. Maximal speed with minimal transition time between the eccentric catch and concentric throw to exploit the stretch-shortening cycle

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

A. Separated from general traffic areas with adequate clearance on all sides for dropped barbells and failed lifts

B. Directly adjacent to cardio equipment for convenient circuit training rotations

C. Against mirrors so athletes can visually monitor their technique during all attempts

D. In the center of the facility surrounded by other stations for motivational atmosphere

129. A strength and conditioning specialist is training 30 athletes in a facility with 10 squat racks. Which organizational approach maximizes efficiency while maintaining safety?

A. All 30 athletes performing bodyweight squats while waiting for available racks

B. Eliminating squats entirely because the facility lacks sufficient equipment for the group size

C. Groups of 3 per rack rotating between squatting, spotting, and resting for continuous workflow and appropriate supervision

D. All 30 athletes observing one demonstration at a single rack for the entire session

130. Collars must be used on all barbell exercises during training. The primary safety purpose is which of the following?

A. Increasing the total weight of the bar for additional resistance

B. Preventing weight plates from sliding off the barbell ends during exercise, which could cause asymmetric loading, loss of control, and injury

C. Improving the athlete's grip by adding friction to the bar surface

D. Collars are purely decorative accessories with no functional safety purpose

131. An athlete's training program includes the power snatch, front squat, incline bench press, dumbbell lateral raise, cable face pull, and front plank. Arranged in proper exercise order, which exercise is performed first?

A. Front plank to pre-activate the core stabilizers before compound movements

B. Dumbbell lateral raise because isolation exercises should always precede compounds

C. Incline bench press because it is the most popular exercise in the program

D. Power snatch because it is the power/explosive exercise requiring the highest neuromuscular coordination and should be performed when the athlete is freshest

132. When spotting a barbell bench press with a single spotter behind the head of the bench, the spotter should use which grip?

A. An alternated grip (one pronated, one supinated) close to the center of the bar for maximum grip security and symmetric force application

B. A wide pronated grip matching the athlete's grip width at the ends of the bar

C. No grip on the bar — hands placed on the athlete's elbows for leverage

D. A supinated grip at the extreme ends of the bar near the weight plates

133. A strength and conditioning specialist observes that an athlete performing a Romanian deadlift maintains slight constant knee flexion, a flat neutral spine, and hinges at the hips with the bar tracking close to the legs. This execution represents which of the following?

A. Dangerous technique requiring immediate correction because the knees should be fully locked

B. Incorrect form because the RDL requires deep knee flexion identical to a conventional squat

C. Correct RDL technique — the hallmarks are slight constant knee flexion, neutral spine, hip hinge, and bar close to the body

D. A completely different exercise unrelated to the Romanian deadlift

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

A. Only lower body power because kicking determines swimming speed exclusively

B. Upper body pulling strength for the swim stroke, rotator cuff health for the repetitively stressed shoulder, and trunk stability for force transfer during swimming

C. Only flexibility because range of motion is the sole quality relevant to swimming performance

D. Only cardiovascular endurance because swimming requires no upper body strength or stability

135. An anti-rotation exercise such as the Pallof press trains the core musculature to resist which force?

A. Spinal flexion force in the sagittal plane as occurs during weighted crunches and sit-ups

B. Spinal extension force in the sagittal plane as occurs during back extensions

C. Lateral flexion force in the frontal plane as occurs during side-bending movements

D. Rotational force — an external load attempts to twist the torso while the athlete maintains neutral trunk alignment

136. The snatch requires the bar to be received overhead with fully locked arms. Before an athlete attempts the full snatch, which mobility prerequisite must be assessed?

A. Overhead squat mobility — the ability to maintain a stable, locked-arm overhead position while squatting to full depth with an upright torso

B. Only ankle dorsiflexion because the snatch is exclusively a lower body exercise

C. Only wrist flexion because the wide grip places no demand on shoulder mobility

D. No mobility prerequisites exist because all athletes can safely perform the snatch

137. A strength and conditioning specialist teaches proper push-up technique before progressing athletes to barbell bench press. Correct push-up execution includes which technical standards?

A. Hips sagging toward the floor creating a visible swayback position throughout the movement

B. Elbows flared to 90 degrees from the torso regardless of shoulder discomfort

C. A straight line from head to heels with core braced, chest touches or nearly touches the floor, and elbows track at approximately 45 degrees from the torso

D. Partial range of motion with elbows bending only 10 to 15 degrees per repetition

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

A. Cable at floor level, pulling upward toward the knees with internal shoulder rotation

B. Cable at face height, pulling toward the face while externally rotating the shoulders and retracting the scapulae

C. Cable above head height, pulling downward toward the waist in a lat pulldown motion

D. Cable at knee height, pulling diagonally across the body in a woodchop pattern

139. A strength and conditioning specialist is programming conditioning for an American football offensive lineman. The position demands 4-to-7-second plays with 25-to-40-second rest. Which conditioning protocol replicates these demands?

A. Continuous 3-mile runs at moderate pace three times per week

B. 400-meter repeats with 60-second rest targeting the glycolytic system

C. 60-minute cycling at 50% of maximum heart rate for aerobic base development

D. Sprint intervals of 5 to 10 yards with 25 to 40 seconds of rest replicating the position's phosphagen-dominant demands and actual work-to-rest ratio

140. A strength and conditioning specialist observes that an athlete performing the overhead press grips the bar excessively wide, placing the elbows lateral to the wrists at the start position. The correct grip width should position the forearms in which alignment?

A. Approximately vertical when the bar is at shoulder height, with wrists directly above the elbows

B. Angled outward at 45 degrees from vertical throughout the entire pressing range of motion

C. As wide as possible to maximize the contribution of the lateral deltoid to the pressing motion

D. As narrow as possible to convert the press into a close-grip triceps isolation exercise

PROGRAM DESIGN (Questions 141–184)

141. A needs analysis for a competitive 100-meter sprinter identifies explosive starting power, maximal sprint velocity, and the ability to maintain speed through the finish as critical performance factors. The race lasts approximately 10 to 12 seconds. The dominant energy system for this event is which of the following?

A. The oxidative system because aerobic metabolism begins contributing after 5 seconds

B. The glycolytic system because the sprint lasts longer than 10 seconds

C. The phosphagen system, which provides the fastest rate of ATP regeneration for maximal-effort activities lasting up to approximately 10 to 15 seconds

D. All three systems contribute equally regardless of the sprint duration or intensity

142. A strength and conditioning specialist classifies exercises for a training program. Which of the following meets the criteria for classification as a power exercise?

A. A seated leg extension performed at a slow, controlled tempo on a machine

B. A seated biceps curl performed with dumbbells at a deliberate 4-second cadence

C. A lateral raise with light dumbbells at a controlled tempo for muscle isolation

D. A power clean performed explosively from the hang or floor position — it is structural (loads the spine), performed explosively (rapid force production), and involves large muscle masses

143. In a training session containing the hang clean, back squat, bench press, lat pulldown, dumbbell lateral raise, and side plank, correct exercise order places which exercise first?

A. Side plank to pre-activate core stabilizers before any loaded exercise

B. Hang clean because it is the power/explosive exercise requiring the highest neuromuscular coordination and should be performed when the athlete is freshest

C. Dumbbell lateral raise because isolation exercises should precede compound movements

D. Lat pulldown because pulling exercises should always be prioritized over pushing exercises

144. For a novice athlete with 2 months of training experience, which training frequency and format is most appropriate?

A. 2 to 3 sessions per week using total-body training with moderate loads, higher repetitions, and emphasis on technique mastery

B. 6 to 7 sessions per week using an advanced body-part split routine with maximal loads

C. 1 session per month using maximal loads to failure on every exercise

D. Daily sessions using only isolation machine exercises at 95% of estimated 1RM

145. According to the repetition maximum continuum, training at 67–85% of 1RM for 6–12 repetitions with 30–90 seconds rest primarily develops which adaptation?

A. Maximal strength through neural adaptation with heavy loading and complete recovery

B. Explosive power through high-velocity ballistic movement at submaximal loads

C. Muscle hypertrophy through moderate loading with mechanical tension and metabolic stress

D. Muscular endurance through sustained low-force, high-repetition contractions

146. An athlete's tested 1RM on the back squat is 170 kg. A strength-focused protocol prescribes 5 sets of 4 at 85% of 1RM with 3-minute rest. What is the prescribed training load?

A. 85 kg calculated as 50% of the 1RM

B. 170 kg using 100% of the 1RM for every working set

C. 200 kg calculated by adding 30 kg to the 1RM

D. Approximately 144 to 145 kg ($170 \times 0.85 = 144.5$ kg)

147. Rest periods of 2 to 5 minutes between sets are specifically prescribed for which training goal?

A. Muscular endurance requiring minimal recovery to maintain metabolic demand

B. Maximal strength and power, where adequate phosphocreatine resynthesis and neural recovery ensure maximal force production on every subsequent set

C. Muscle hypertrophy requiring elevated metabolic stress from incomplete recovery

D. Cardiovascular conditioning requiring sustained elevated heart rate throughout the session

148. Daily undulating periodization (DUP) varies intensity and volume within each training week. A typical DUP week might include Monday (hypertrophy: 4×10 at 70%), Wednesday (strength: 5×4 at 85%), and Friday (power: 5×3 at 75% explosive). The primary advantage of DUP is which of the following?

A. More frequent exposure to different training stimuli within each week, potentially preventing accommodation and allowing simultaneous development of multiple physical qualities

B. DUP eliminates the need for any planned progression because daily variation is completely random

C. DUP never uses heavy loads making it inherently safer than all other periodization models

D. DUP produces identical outcomes to performing the same workout every session

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

A. Volume and intensity both increase simultaneously throughout the entire macrocycle

B. Volume and intensity remain constant and unchanging across all phases without progression

C. Intensity gradually increases while volume gradually decreases across sequential mesocycles

D. Intensity decreases while volume increases across sequential mesocycles

150. Block periodization concentrates training on targeted qualities within each block. The typical three-block sequence is which of the following?

A. Realization (peaking) → Transmutation (sport-specific) → Accumulation (high volume)

B. Competition → Transition → General preparation with no periodization structure

C. Muscular endurance → Flexibility → Cardiovascular conditioning exclusively

D. Accumulation (high volume, moderate intensity) → Transmutation (higher intensity, sport-specific) → Realization (low volume, peaking for competition)

151. During the competitive in-season period, a strength and conditioning specialist reduces training frequency and volume while maintaining intensity. What outcome is expected?

A. Dramatic strength loss because any reduction in volume or frequency causes detraining

B. Strength and power maintenance because intensity — the most critical variable for preventing detraining — has been preserved

C. Significant additional strength gains from the reduced training load

D. Complete detraining within 48 hours regardless of maintained intensity

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

A. 2 to 4 weeks of unstructured, low-intensity active recovery focused on physical and psychological restoration, minor injury treatment, and motivation renewal

B. 12 weeks of maximal-intensity training to immediately prepare for next season

C. 6 months of complete bed rest with zero physical activity

D. The transition period should be eliminated because continuous maximal training is optimal

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

A. 85 to 95% of back squat 1RM for maximum force contribution at very slow velocity

B. 50 to 70% providing balanced but suboptimal force and velocity contributions

C. 0 to 30% of back squat 1RM where lighter loading allows the high velocity needed to maximize the velocity component of the power equation

D. Equal peak power at all loads because loading does not affect power output

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

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

B. 30 to 40% of 1RM using very light loads moved explosively

C. 95 to 100% of 1RM using near-maximal loads at very slow velocity

D. 70 to 80% of 1RM because the hang clean is a ballistic exercise where sufficient mass is needed for peak power expression while velocity remains high

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

A. 250 foot contacts per session consisting exclusively of high-intensity depth jumps

B. 80 to 100 foot contacts per session distributed across exercises of varying intensity

C. 500 foot contacts per session to maximize the training stimulus from the very first session

D. 10 foot contacts per session regardless of exercise type or training level

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

A. At the beginning of the session after a thorough warmup, when the athlete is fresh for maximal effort and proper technique on every repetition

B. At the end of the session after heavy resistance training and conditioning to maximize fatigue

C. Only during rest days with no other physical activity within 72 hours before or after

D. Immediately after a 5-kilometer conditioning run to simulate game-day fatigue conditions

157. An athlete with a back squat at the 88th percentile for their sport but a vertical jump at the 32nd percentile demonstrates which training deficiency?

A. Insufficient maximal strength requiring even heavier squat loading despite the high ranking

B. No deficiency because maximal strength is the sole determinant of jump height

C. A rate of force development deficit — adequate strength but poor ability to express it rapidly, requiring increased explosive training (plyometrics, Olympic lifts, jump squats)

D. Excessive flexibility impairing force transfer from the lower body to the ground

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

A. Exclusively heavy resistance training with no conditioning of any type

B. Only long-distance running at low intensity performed five days per week

C. Only static stretching for 60 minutes per session

D. Aerobic base training (tempo runs, fartlek), anaerobic interval training (repeated sprints with sport-specific rest), and reactive agility conditioning

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

A. Maximizing training volume and intensity for immediate preparation for next season

B. Physical and psychological recovery, minor injury treatment, and motivation restoration for 2 to 4 weeks

C. Complete cessation of all physical activity for a minimum of 6 months

D. Introducing entirely new sports that the athlete has never practiced before

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

A. Subjective report of feeling ready with no testing required

B. Bilateral strength and functional symmetry within 10%, sport-specific movement competency, and medical clearance

C. Ability to walk without a limp as the sole return criterion

D. Completion of any group exercise class regardless of content or intensity

161. A needs analysis for a competitive ice hockey forward reveals 45-to-60-second shifts with 2-to-3-minute bench rest. The conditioning program should target which energy system?

A. Exclusively the oxidative system because total game duration exceeds 60 minutes

B. Only the phosphagen system because individual skating strides last less than 1 second

C. No energy system conditioning because skating technique alone determines hockey performance

D. The glycolytic system using 45-to-60-second high-intensity intervals with 2-to-3-minute rest replicating shift demands

162. For an advanced athlete with 7 years of training preparing for a single major competition, which periodization model is most appropriate?

A. A fixed program performed identically for 52 weeks with no variation or planning

B. A beginner program with 2 sessions per week at 60% 1RM throughout the entire year

C. Block periodization with accumulation, transmutation, and realization phases targeted to peak at the competition date

D. Random exercise selection with no structure, overload, or planned peaking strategy

163. An athlete's strength gains have plateaued after 20 weeks of the same program. The principle of accommodation predicts that the response to a constant stimulus diminishes over time. The most appropriate intervention is which of the following?

A. Introducing variation in training variables — exercises, loads, volumes, periodization model — to provide novel stimuli that overcome the adaptation plateau

B. Continuing the identical program indefinitely because all plateaus resolve spontaneously

C. Complete cessation of all training for 6 months before restarting

D. Reducing all loads to 30% of 1RM permanently

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

A. Immediate return to full-intensity sprinting on the first day of clearance

B. Progressive loading from low-intensity exercises through sport-specific movements, meeting objective bilateral symmetry criteria (within 10%) before unrestricted return

C. Exclusive upper body training for the remainder of the athlete's career

D. Continued complete rest for 12 additional months regardless of medical clearance

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

A. Realization → Transmutation → Accumulation in reverse order

B. Competition → Transition → General preparation only

C. Flexibility → Cardiovascular conditioning → Muscular endurance exclusively

D. Accumulation (high volume/moderate intensity) → Transmutation (higher intensity/sport-specific) → Realization (low volume/peaking)

166. When prescribing rest periods for muscular endurance training (less than 67% 1RM, 12+ repetitions), the recommended interval is which of the following?

A. 2 to 5 minutes for complete phosphocreatine and neural recovery

B. 8 to 10 minutes for full systemic recovery before each set

C. 30 seconds or less to maintain elevated metabolic demand throughout the session

D. No structured rest — continuous exercise for 90 minutes without stopping

167. A strength and conditioning specialist programs 5 sets of 2 at 93% 1RM with 5-minute rest. This protocol develops which physical quality?

A. Maximal strength and neural adaptation through near-maximal loading with complete recovery

B. Muscular endurance through high-repetition sustained work

C. Muscle hypertrophy through moderate loading with metabolic stress

D. Aerobic conditioning through sustained elevated heart rate

168. A strength and conditioning specialist calculates volume load for a training session: 4 sets × 8 reps × 110 kg on the back squat. The total volume load is which of the following?

A. 440 kg calculated as sets multiplied by the load alone

B. 3,520 kg calculated as 4 × 8 × 110 using the standard formula

C. 880 kg calculated as repetitions multiplied by load only

D. 32 repetitions calculated as sets multiplied by repetitions only

169. An athlete performing 5 sets of 5 at 85% 1RM with 3-minute rest is training for which primary quality?

A. Muscular endurance through sustained moderate-intensity work

B. Muscle hypertrophy through moderate loading with short rest periods

C. Cardiovascular conditioning through elevated heart rate during lifting

D. Maximal strength through heavy loading with adequate neural recovery

170. The general preparation phase of the annual training plan emphasizes which foundational qualities?

A. Sport-specific power and speed for immediate competitive readiness

B. Complete rest with no training stimulus of any kind for the entire phase

C. A broad base of hypertrophy, general strength, work capacity, and aerobic fitness

D. Exclusively technical sport skill practice with no physical training

171. The specific preparation phase shifts emphasis from general fitness to which focus?

A. Sport-specific qualities including power, speed, agility, and sport-specific conditioning

B. Maximum aerobic endurance through exclusive long-distance running

C. Complete rest to conserve energy for the upcoming competitive season

D. Only flexibility training because other qualities maintain automatically

172. An athlete's training log shows: Week 1 = 38,000 kg, Week 2 = 42,000 kg, Week 3 = 46,000 kg, Week 4 = 28,000 kg. Week 4 represents which training strategy?

A. A training error that accidentally reduced volume below plan

B. A deload week designed to manage accumulated fatigue before the next loading cycle

C. A peaking week for new 1RM records at competition intensity

D. Complete cessation of all training for the entire week

173. A strength and conditioning specialist designs a conditioning protocol for a tennis player: 6-second all-out shuttle sprints with 90-second passive rest (approximately 1:15 ratio). This protocol targets which energy system?

A. The glycolytic system through prolonged moderate-intensity intervals

B. The oxidative system through sustained low-intensity continuous activity

C. All three systems equally regardless of work-to-rest ratio or duration

D. The phosphagen system with near-complete phosphocreatine recovery between maximal efforts

174. An athlete who excels on the field with explosive movements but struggles with heavy lifts in the weight room has which specific training deficiency?

A. Excessive explosive ability that cannot be further developed through any training

B. No deficiency because field performance always surpasses weight room performance

C. A maximal strength deficit — their explosive ability outpaces their force production capacity, and heavy resistance training (85%+ 1RM) develops the larger force foundation

D. A flexibility deficit that prevents heavy lifting due to range of motion restrictions

175. A novice athlete should use which loading strategy during the first 4 to 6 weeks of a resistance training program?

A. Moderate loads (60–70% estimated 1RM) with higher repetitions (10–15) emphasizing technique mastery, work capacity development, and connective tissue adaptation

B. Maximal loads at 95% 1RM with single repetitions from the very first training session

C. Only plyometric depth jumps with no foundational strength training of any kind

D. No external loading for the first 12 months while focusing exclusively on flexibility

176. Plyometric training frequency should be limited to 2 to 3 sessions per week with at least 48 to 72 hours between sessions primarily because of which physiological requirement?

A. The recovery time is arbitrary with no physiological basis or justification

B. Adequate recovery of musculotendinous structures experiencing significant eccentric loading during plyometric exercises

C. The 48-to-72-hour interval is needed only for cognitive processing of plyometric movement patterns

D. The recovery is needed exclusively for the cardiovascular system to return to resting levels

177. A strength and conditioning specialist wants to develop both maximal strength and explosive speed in a sprinter's weekly plan. Which approach addresses both ends of the force-velocity continuum?

A. Training exclusively with heavy loads above 90% 1RM for every exercise and session

B. Training exclusively with bodyweight exercises at maximum velocity for all sessions

C. Eliminating all resistance training and relying solely on sprint practice

D. Combining heavy strength training (85%+ 1RM) on some days with explosive exercises (Olympic lifts, plyometrics, jump squats at 30–50% 1RM) on other days

178. A training program for a martial artist competing in 3-minute rounds with 1-minute rest should primarily target which energy system?

A. Only the phosphagen system because individual strikes last less than 0.5 seconds

B. Only the oxidative system because total fight duration exceeds 5 minutes

C. The glycolytic system because 3-minute rounds of sustained high-intensity fighting fall within the glycolytic-dominant range, supplemented by the phosphagen system for explosive techniques and the aerobic system for between-round recovery

D. No energy system training because technique alone determines competitive success

179. An in-season maintenance program prescribes 2 sessions per week at 80–85% 1RM with reduced volume. Which variable must be maintained to prevent detraining?

A. Training intensity (percentage of 1RM), which research consistently identifies as the most critical variable for in-season strength maintenance

B. Training volume, which must remain at preparatory-period levels throughout the competitive season

C. Training frequency, which must stay at 5 sessions per week regardless of competition schedule

D. Exercise variety, with a completely new exercise introduced at every session

180. An athlete's annual training plan should organize the year in which sequence?

A. Competition → Transition → General preparation → Specific preparation

B. General preparation → Specific preparation → Competition → Transition

C. Transition → Competition → General preparation → Specific preparation

D. Specific preparation → General preparation → Transition → Competition

181. A needs analysis for a competitive rock climber identifies grip endurance, upper body pulling strength, core stability, and body composition optimization. Which exercise combination addresses these needs?

A. Exclusively bench press and shoulder press because pushing strength determines climbing ability

B. Only cardiovascular training on a stationary bicycle for 60 minutes

C. Exclusively lower body exercises because leg strength is the primary climbing performance factor

D. Pull-up/rowing variations for pulling strength, dead hangs/farmer's carries for grip endurance, anti-extension/anti-rotation core exercises, and nutritional guidance for body composition

182. A strength and conditioning specialist designs a weekly DUP plan: Monday = 4×10 at 70% (hypertrophy), Wednesday = 5×4 at 85% (strength), Friday = 5×3 at 75% explosive tempo (power). This structure provides which advantage?

A. DUP eliminates the need for planning because all variation is random

B. DUP never uses heavy loads, reducing all injury risk

C. More frequent exposure to different training stimuli within each week, preventing accommodation and enabling simultaneous development of multiple physical qualities

D. Identical outcomes to performing the same workout at every session

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

A. Belt squats, leg press, goblet squats with modified grip, and other exercises not requiring conventional barbell grip

B. No training of any kind until the wrist is fully healed

C. Only upper body machine exercises to maintain strength in uninjured areas

D. Heavy barbell back squats with standard grip because the wrist will adapt under load

184. A strength and conditioning specialist programs conditioning for a soccer goalkeeper whose demands include explosive saves, rapid direction changes, and 2-to-5-second sprints with variable rest. Which work-to-rest ratio best replicates these demands?

A. 1:1 ratio targeting the oxidative system with equal durations

B. 1:8 to 1:12 ratio targeting the phosphagen system with near-complete recovery between explosive efforts

C. No structured rest because goalkeepers should train continuously for 90 minutes

D. 1:3 ratio targeting the glycolytic system with moderate recovery

TESTING AND EVALUATION (Questions 185–206)

185. A strength and conditioning specialist needs to assess lower body explosive power in 45 athletes during a 90-minute session. Which test is most practical and valid?

A. Laboratory-based isokinetic dynamometry requiring 25 minutes per individual athlete

B. Force plate analysis with synchronized 3D motion capture requiring specialized personnel

C. Underwater weighing to assess body composition as a proxy for power output

D. The vertical jump (CMJ) using a Vertec device — valid, reliable, practical for large groups, and efficient for the time available

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

A. Reliability — consistency and reproducibility ensuring that observed changes reflect true performance improvement rather than measurement error

B. Face validity based on the test's surface-level appearance of relevance

C. Construct validity demonstrating accurate measurement of the underlying quality

D. Criterion validity proven through comparison with a gold standard

187. During 1RM testing, an athlete successfully lifts 130 kg with proper technique, then fails at 135 kg. The 1RM is which value?

A. 135 kg because the athlete attempted this weight

B. 132.5 kg as the average of successful and failed attempts

C. The test must be restarted because any failed attempt invalidates all results

D. Neither can be determined from this information

188. An athlete's CMJ height is 62 cm and SJ height is 51 cm. The 11 cm difference reflects which capacity?

A. Maximum aerobic power during the jump testing session

B. The athlete's stretch-shortening cycle utilization — stored elastic energy and stretch reflex contribution from the countermovement enhancing concentric force production

C. Hamstring-to-quadriceps ratio as an ACL injury predictor

D. Absolute maximal strength of the quadriceps independent of contraction velocity

189. A sprint timing comparison between electronic gates and hand timing reveals systematic differences. Electronic timing is more accurate because it eliminates which error source?

A. Wind resistance affecting the athlete's running velocity during the sprint

B. Temperature effects on muscle contraction speed during cold weather testing

C. The color of lane markings on the testing surface affecting athlete motivation

D. The human timer's reaction time variability, which introduces approximately 0.1 to 0.3 seconds of error per measurement

190. Skinfold body composition assessment involves a two-step calculation. The correct sequence is which of the following?

A. Skinfold thicknesses are entered into population-specific prediction equations to estimate body density, then converted to body fat percentage using equations such as the Siri formula

B. Skinfolds directly produce body fat percentage without intermediate calculation

C. Skinfolds estimate bone mineral density with no relationship to body fat

D. Skinfolds are multiplied by body weight to produce fat mass in kilograms

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

A. The ambient room temperature during the measurement session

B. The brand of athletic shoes worn by the athlete during the assessment

C. The athlete's hydration status, which affects electrical conductivity and can alter body fat estimates by several percentage points

D. The number of people present in the room during the measurement

192. A bilateral single-leg hop comparison reveals: right leg = 42 cm, left leg = 34 cm — approximately 19% asymmetry. Based on clinical thresholds, this suggests which of the following?

A. Normal bilateral variation requiring no intervention

B. A clinically significant asymmetry exceeding the 10–15% threshold warranting corrective programming and possible medical evaluation

C. The right leg is overtrained and should be detrained immediately

D. The left leg is permanently damaged beyond rehabilitation

193. An athlete's test results: back squat = 85th percentile, vertical jump = 33rd percentile, pro agility = 60th percentile, 1.5-mile run = 58th percentile. Which quality is the highest programming priority?

A. Maximal strength, already well-developed at the 85th percentile

B. Aerobic endurance at the 58th percentile

C. Agility at the 60th percentile

D. Explosive power (vertical jump at 33rd percentile) — disproportionately low relative to high strength, indicating a rate of force development deficit

194. Testing should be conducted under standardized conditions. The most critical factor for valid longitudinal comparisons is which of the following?

A. Identical conditions across sessions — same warmup, equipment, test order, time of day, and environmental conditions

B. Different tests at each time point to prevent the athlete from adapting to the testing protocol

C. Allowing athletes to choose their own warmup and conditions at each session

D. Testing immediately after heavy training to evaluate performance under fatigue

195. An athlete returning from ACL reconstruction achieves 89% bilateral symmetry on single-leg hop testing. Based on the 90% criterion, the recommendation is which of the following?

A. The athlete has met all criteria and should return to unrestricted competition immediately

B. Continue progressive strengthening because the surgical leg has not yet met the 90% threshold

C. Continue progressive strengthening because the surgical leg has not yet met the 90% symmetry threshold required for return consideration

D. Bilateral hop testing has no relevance to ACL return-to-play decisions

196. Normative data tables for interpreting test results must be matched to which population variables?

A. Only the athlete's shoe size and dominant hand

B. Sport, competitive level, age, and sex — using an inappropriate reference population produces misleading rankings

C. Only the specific testing facility and brand of equipment used

D. Only the day of the week the test was administered

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

A. Only jump height from standing reach minus jumping reach

B. Only body weight measured before the test

C. Only flight time from takeoff to landing

D. Peak GRF, rate of force development, impulse, and power output in addition to jump height

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

A. It primarily measures hamstring and lower back flexibility, does not assess other joints, and is influenced by the athlete's limb proportions

B. It requires expensive laboratory equipment unavailable in field settings

C. It takes more than 30 minutes per athlete to administer properly

D. It measures only shoulder flexibility with no relevance to the lower body

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

A. Goniometry is less accurate than the sit-and-reach for every joint in the body

B. Goniometry provides identical information to the sit-and-reach with no additional value

C. Joint-specific range of motion measurements at any individual joint, identifying restrictions the sit-and-reach cannot detect

D. Goniometry can only measure hip ROM with no application for other joints

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

A. Daily to capture the most granular data on performance fluctuations

B. At the beginning and end of each major training phase and at pre/post-season time points

C. Only once at the beginning of the athlete's career with no subsequent testing

D. Randomly with no planned schedule to prevent athletes from preparing for tests

201. Submaximal 1RM prediction equations are most accurate when the repetitions completed are within which range?

A. 25 to 30 repetitions providing maximum data points for statistical prediction accuracy

B. 15 to 20 repetitions to fully demonstrate the athlete's muscular endurance capacity

C. Exactly 1 repetition, eliminating the need for any prediction equation altogether

D. 10 or fewer repetitions, because the relationship between reps and 1RM becomes less linear at higher counts

202. When conducting 1RM testing, the standardized protocol includes approximately how many progressive warmup sets before maximal attempts?

A. 3 to 4 progressively heavier warmup sets (approximately 50%, 70%, 80–85% of estimated 1RM) before single repetitions at near-maximal loads

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

C. One set of 50 light repetitions to maximize blood flow before any heavy lifting

D. 10 sets of 10 repetitions at increasing loads for maximum physiological preparation

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

A. A straight-line sprint of 40 yards with no direction changes

B. Repeated vertical jumps for 60 seconds measuring total height

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

D. An agility ladder drill with predetermined fixed footwork patterns

204. An athlete's vertical jump has not improved after 12 weeks of plyometric training. Their squat 1RM is only 1.1× body weight. Which program modification addresses this plateau?

A. Continuing the identical plyometric program for 12 more weeks without modification

B. Adding heavy resistance training to develop the strength base needed for plyometrics — the squat below 1.5× body weight limits SSC effectiveness

C. Eliminating all lower body exercises and focusing only on upper body development

D. Complete cessation of all training for 6 months before reassessing

205. The Cooper 12-minute run and 1.5-mile run both estimate VO_2max. The shared limitation of both tests is which of the following?

A. They require laboratory metabolic analysis equipment unavailable in field settings

B. They cannot distinguish between athletes of different fitness levels

C. They can only be administered to one athlete at a time

D. They depend on the athlete's self-pacing ability at maximal effort, influenced by motivation and pacing experience

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

A. Only maximal bench press because upper body strength is the sole performance determinant

B. Only body composition because lean athletes always outperform all others

C. Only flexibility because basketball requires no strength, speed, power, or endurance

D. Aerobic capacity, sprint speed, agility/change of direction, lower body power, upper body strength, and body composition

ORGANIZATION AND ADMINISTRATION (Questions 207–220)

207. A university plans a strength and conditioning facility accommodating 50 athletes simultaneously. Using the NSCA minimum of 40 sq ft per athlete, the minimum floor space is which of the following?

A. 500 square feet based on 10 square feet per athlete

B. 1,000 square feet based on 20 square feet per athlete

C. 2,000 square feet (50 × 40), with the upper guideline of 60 sq ft producing 3,000 sq ft

D. 5,000 square feet based on 100 square feet per athlete

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

A. Only once when the facility first opens

B. At least annually with all staff participating, and ideally more frequently

C. Every 10 years aligned with facility renovation cycles

D. Only after an emergency has occurred to evaluate the response

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

A. Advanced cardiac life support requiring physician-level training

B. Emergency medical technician certification at the paramedic level

C. Wilderness first responder certification for remote training environments

D. CPR and AED use from a recognized provider

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

A. The degree of care, skill, and diligence a reasonably competent professional with similar training would exercise under similar circumstances

B. The maximum insurance coverage required by law for fitness facilities

C. The minimum salary a professional must earn to demonstrate competence

D. The number of continuing education credits required for recertification

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

A. Claims based on inherent risks clearly disclosed and voluntarily assumed

B. Claims for normal muscle soreness from appropriately designed training

C. Claims from participants who acknowledged documented inherent risks

D. Recklessness or willful disregard for participant safety that goes beyond ordinary negligence

212. An athlete asks the specialist to diagnose chronic shoulder pain and prescribe rehabilitation. According to scope of practice, the response should be which of the following?

A. Diagnose the condition and prescribe comprehensive rehabilitation exercises

B. Refer to a qualified medical professional (physician, athletic trainer, physical therapist)

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

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

213. Which activity falls within the CSCS scope of practice?

A. Diagnosing musculoskeletal injuries through physical examination

B. Prescribing individualized meal plans with caloric and macronutrient targets

C. Providing psychological counseling for clinical depression and anxiety

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

214. Damaged equipment should be handled by which protocol?

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

B. Continued use until complete failure because replacement is expensive

C. Hidden from athletes to prevent unnecessary concern about equipment quality

D. Only the manufacturer can evaluate damage, so nothing should be done until they visit

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

A. Always comply because the coach has final authority over all training decisions

B. Resign immediately without attempting to discuss the disagreement

C. Decline unsafe practices, explain the evidence-based rationale, and advocate for athlete safety

D. Implement the demands but document objections in a private journal

216. Supervision ratios should be adjusted based on which factors?

A. Only the total number of athletes regardless of exercises performed

B. The complexity of exercises, experience level of athletes, and qualifications of supervisory staff

C. Only the time of day the training session occurs

D. Only the physical dimensions of the facility without considering activities

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

A. Only financial statements and tax returns

B. Only social media posts documenting training sessions

C. Only the head coach's practice plans and game film

D. Athlete training logs, testing data, signed waivers, medical clearance forms, equipment maintenance records, and incident reports

218. A colleague without appropriate credentials has been independently teaching heavy power cleans to inexperienced athletes. The appropriate response is which of the following?

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

B. Ignoring the situation because it doesn't involve the specialist's athletes

C. Encouraging the colleague to increase the load to accelerate athlete development

D. Posting about the situation on social media to alert the public

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

A. Allow the athlete to train because enforcing footwear rules is unnecessarily strict

B. Allow barefoot training as an alternative to sandals

C. Enforce the policy — the athlete cannot train until returning with proper footwear, as open-toed shoes create unacceptable risk from dropped weights

D. Permanently modify the policy for this specific athlete

220. The NSCA professional standards establish that the CSCS has which authority regarding the strength and conditioning program?

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

B. Authority limited to equipment purchasing and facility decoration only

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

D. Ultimate professional authority and responsibility for the design and implementation of the strength and conditioning program

PRACTICE EXAM 6 — ANSWER KEY WITH EXPLANATIONS

SECTION 1 — SCIENTIFIC FOUNDATIONS

EXERCISE SCIENCE (Questions 1–52)

1. A — Chronic resistance training and sprint work promote the well-documented conversion of Type IIx fibers to the more fatigue-resistant Type IIa phenotype. This is the most consistently observed fiber type transition in response to heavy training. The Type IIa fibers retain fast-twitch contractile properties while gaining greater oxidative capacity.

2. C — T-tubules conduct the action potential from the sarcolemma surface deep into the fiber's interior, ensuring that the signal for calcium release reaches the sarcoplasmic reticulum throughout the entire cross-section of the fiber simultaneously. Without T-tubules, only the outermost myofibrils would receive the contraction signal, producing uncoordinated force generation.

3. D — The law of diminishing returns explains that the experienced athlete has already captured most available neural and structural adaptations over 8 years, leaving progressively smaller gains available. The novice has abundant untapped neural and structural adaptation potential, producing rapid early improvements. Greater training specificity and sophistication yield smaller incremental gains in advanced athletes.

4. B — The A-band represents the full length of the thick (myosin) filaments and does not change width during contraction because the myosin filaments themselves do not shorten — the thin filaments slide over them. The I-band and H-zone both narrow during contraction, and the Z-lines move closer together as the sarcomere shortens.

5. A — The exponential rise from 1.8 mmol/L at 200 watts to 4.5 mmol/L at 250 watts represents the inflection point where lactate production began exceeding clearance. Below 200 watts, production and clearance were balanced. The threshold occurs between 200 and 250 watts, identifying the intensity above which acidosis progressively impairs performance.

6. C — The first athlete reaches 3,500 N in 180 ms compared to 320 ms — demonstrating a faster rate of force development (force ÷ time). In athletic movements with limited ground contact time (80-200 ms during sprinting), faster RFD produces greater impulse within the available contact window, resulting in superior explosive performance.

7. D — The sustained stretch at the bottom of the RDL activates the muscle spindle, which detects both the magnitude and rate of muscle length change. The persistent stretch reflex stimulation from

the held position contributes to involuntary contraction of the hamstrings that can manifest as cramping, particularly when the muscle is under load.

8. B — The GTO detects the elevated tension during the 6-second isometric contraction and sends inhibitory signals through an Ib inhibitory interneuron to reduce alpha motor neuron activity to the hamstrings. This autogenic inhibition temporarily decreases the muscle's resistance to stretch, allowing a greater passive range of motion on the subsequent stretch.

9. A — The 11 cm difference represents the stretch-shortening cycle contribution. The rapid countermovement stores elastic energy in the musculotendinous unit and activates the stretch reflex through muscle spindle stimulation. Both mechanisms augment concentric force production during the takeoff, adding power that is unavailable during the static squat jump.

10. C — After stroke volume plateaus at approximately 40-60% of VO_2max, further increases in cardiac output depend on continued increases in heart rate driven by progressive sympathetic nervous system activation. Heart rate increases linearly with exercise intensity until approaching the age-predicted maximum (approximately 220 minus age).

11. D — Eccentric hypertrophy increases left ventricular chamber size, enhancing maximal stroke volume and cardiac output — directly relevant to endurance performance. Concentric hypertrophy thickens the ventricular wall, increasing the heart's pressure-generating capacity — relevant to tolerating the extreme acute blood pressure spikes during heavy resistance exercise.

12. B — Individuals with uncontrolled hypertension or cardiovascular disease are at elevated risk during the Valsalva maneuver because the extreme transient blood pressure spikes (potentially exceeding 400/300 mmHg) may exceed the structural limits of weakened blood vessels or the functional capacity of a compromised heart. This technique is safe for healthy, trained athletes.

13. A — The greatest acute testosterone response occurs with protocols using large muscle mass exercises, moderate-to-high intensity (70-85% 1RM), moderate-to-high volume (multiple sets), and short rest periods (60-90 seconds). This combination provides the mechanical and metabolic stimulus that maximizes the endocrine signaling cascade for testosterone release.

14. C — Suppressed testosterone, elevated cortisol, declining T:C ratio over 8 weeks, persistent fatigue, performance decline, insomnia, and motivational loss collectively represent overtraining syndrome. This chronic maladaptive state indicates that cumulative training stress has exceeded recovery capacity, producing systemic hormonal disruption requiring reduced training and medical evaluation.

15. D — Mechano-growth factor (MGF), the locally produced muscle-derived variant of IGF-1, activates satellite cells and stimulates muscle protein synthesis through the mTOR pathway in response to mechanical loading. This local paracrine signaling is a key mediator of the hypertrophic response to resistance training.

16. B — The high jump requires unilateral takeoff power from a single-leg base, rapid rate of force development during the brief contact phase, vertical power expression through the stretch-shortening cycle, and explosive movement patterns. Slow bilateral squats alone do not provide the specific stimulus for these demands.

17. A — The VO_2 plateau despite increasing workload, combined with RER above 1.10 and blood lactate of 11 mmol/L, confirms the athlete has reached VO_2max — the absolute ceiling of aerobic energy production. These secondary criteria (high RER, high lactate) validate that the plateau represents a true physiological maximum.

18. D — Full PCr replenishment after maximal depletion requires 3-5 minutes. Without adequate rest, subsequent sprints begin with progressively depleted PCr stores, forcing greater reliance on glycolysis with its fatigue-inducing hydrogen ion accumulation. The extended rest ensures maximal phosphagen availability for quality training.

19. C — A 22-second sprint at near-maximal intensity falls within the glycolytic-dominant duration range. While the phosphagen system contributes heavily during the first 6-10 seconds, the glycolytic system provides the dominant ATP contribution throughout the majority of the 200-meter race distance.

20. B — During 30-second all-out efforts, rapid glycolysis produces hydrogen ions that accumulate in the muscle, reducing intracellular pH below optimal levels. This acidosis impairs cross-bridge cycling, calcium release, and enzymatic function — producing the characteristic burning sensation and progressive force decline.

21. D — As intensity increases above 60-75% of VO_2max, the body shifts to predominantly carbohydrate (muscle glycogen and blood glucose) metabolism because carbohydrate pathways produce ATP at a faster rate than fat oxidation. The escalating energy demand cannot be met by the slower rate of fat metabolism alone.

22. A — Oxygen serves as the final electron acceptor at the end of the electron transport chain, combining with electrons and hydrogen ions to form water. Without oxygen, electrons cannot exit the chain, NADH and $FADH_2$ accumulate in their reduced forms, and aerobic ATP production ceases entirely.

23. C — The crossover concept describes the intensity-dependent shift in substrate dominance from predominantly fat oxidation at low intensities to predominantly carbohydrate oxidation at higher intensities. As exercise intensity increases, the body progressively relies more on the faster carbohydrate pathways to meet the escalating ATP demand.

24. B — Net upward force = GRF minus gravitational force = 2,700 - 883 = 1,817 N upward. Acceleration = net force ÷ mass = 1,817 ÷ 90 = 20.2 m/s^2 upward. Only the force above body weight produces upward acceleration — the first 883 N simply supports the athlete's mass against gravity.

25. D — The forward lean during 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 inertia and generates forward momentum from the stationary start.

26. C — At the sticking point near the chest, two factors combine: the maximum moment arm (requiring the greatest torque) and the lengthened pectoralis position with suboptimal actin-myosin overlap (reducing available cross-bridges and force production). This dual mechanical and physiological disadvantage creates the weakest point in the pressing range.

27. A — In third-class levers, the short effort arm creates a mechanical disadvantage for force — the muscle must produce force many times greater than the external load. However, this arrangement favors speed and range of motion at the distal end because a small muscle shortening produces large movement at the far end of the lever.

28. D — Chronic heavy training reduces the GTO's inhibitory influence on the alpha motor neurons, allowing trained athletes to voluntarily recruit a greater percentage of their motor unit pool during maximal efforts. This neural disinhibition enables force production closer to the true structural capacity of the musculotendinous unit.

29. B — When the amortization phase exceeds 250 ms, stored elastic energy dissipates as heat rather than being returned as mechanical work during the concentric phase. The stretch reflex contribution also diminishes because the rapid transition that maximally stimulates the spindle has been disrupted. Both SSC mechanisms are lost.

30. C — Wolff's Law predicts bone remodeling in response to mechanical stress. Ground-based resistance exercises (squats, deadlifts, weighted lunges) apply large compressive and impact forces directly to the weight-bearing skeleton, providing the greatest osteogenic stimulus. Non-weight-bearing exercises like cycling and aquatic training provide minimal bone-loading stimulus.

31. A — With identical 1RM values, the 16 cm jump height difference indicates superior rate of force development in Athlete A. During the brief ground contact time of a jump, Athlete A produces force more rapidly, generating a greater impulse that translates to higher takeoff velocity and jump height despite equal maximal strength.

32. D — At approximately knee height with the torso inclined forward, the horizontal distance between the barbell and the lumbar spine is at its maximum. Because torque = force × moment arm, this position creates the greatest flexion torque on the lumbar spine. As the lifter approaches lockout and the torso becomes vertical, this moment arm decreases.

33. B — The force-velocity curve establishes that different training goals require different loading strategies: heavy loads at slow velocities for maximal strength (high-force end), moderate loads at moderate-to-high velocities for power (middle region), and light loads at high velocities for speed (high-velocity end). Program design must target the specific region relevant to the athlete's needs.

34. C — Aerobic capacity (VO_2max) declines most rapidly during detraining, with measurable reductions within 1-2 weeks and significant losses by 6 weeks. Maximal strength is more resistant, maintaining for 2-4 weeks or longer. This hierarchy guides which qualities to prioritize during injury rehabilitation.

35. A — At the bottom of the curl, the biceps is in a lengthened position with suboptimal actin-myosin overlap (fewer cross-bridges forming), and the moment arm of the dumbbell relative to the elbow joint is near its maximum (requiring greater torque). This combined mechanical and physiological disadvantage creates the sticking point.

36. D — Increased capillary density expands the surface area available for oxygen and nutrient exchange between the blood and muscle fibers and enhances the removal of metabolic waste products (CO_2, hydrogen ions, heat). Greater capillarization also reduces the diffusion distance between the capillary and the mitochondria.

37. B — The high maximal cardiac output (30 L/min) is primarily enabled by increased maximal stroke volume from eccentric cardiac hypertrophy (enlarged left ventricular chamber), increased blood volume (enhancing venous return and filling), and enhanced contractility (more forceful ventricular contraction). These allow more blood pumped per beat.

38. C — Vasodilation in working muscles reduces total peripheral resistance — the resistance to blood flow through the systemic circulation. Because diastolic pressure reflects peripheral resistance during cardiac relaxation, the reduced resistance prevents diastolic pressure from rising despite the increased cardiac output.

39. A — The combination of 8-month amenorrhea, grossly inadequate caloric intake (1,300 kcal with 3 hours daily training), and DEXA-confirmed decreased bone mineral density represents Relative Energy Deficiency in Sport (RED-S). Low energy availability drives menstrual dysfunction and compromised bone health.

40. D — Cortisol's acute catabolic actions include stimulating protein degradation (breaking down muscle protein) and gluconeogenesis (converting amino acids to glucose in the liver). These actions mobilize amino acid substrates to provide glucose for the brain and other glucose-dependent tissues during physical stress.

41. B — A declining T:C ratio over several weeks indicates that catabolic processes may be outpacing anabolic recovery. This shift suggests insufficient recovery relative to training stress, potentially indicating functional overreaching or the early stages of overtraining syndrome. Trend monitoring provides more meaningful data than single time-point measurements.

42. C — Post-exercise insulin stimulates amino acid uptake into muscle cells, inhibits protein degradation, and promotes glycogen synthesis. When combined with adequate protein and carbohydrate intake, the insulin response creates an anabolic environment that supports muscle repair and glycogen restoration during the critical post-exercise recovery window.

43. A — Stable testosterone with decreased resting cortisol produces a favorable T:C ratio, indicating positive adaptation. This hormonal profile, combined with steady performance improvement and subjective recovery, confirms successful program design. The athlete is adapting positively without signs of overreaching or overtraining.

44. D — Enhanced androgen receptor density increases the muscle's sensitivity to circulating testosterone, amplifying the anabolic signal at the tissue level. This means the muscle responds more effectively to each testosterone molecule, potentially enhancing the hypertrophic and strength response even without changes in basal circulating testosterone levels.

45. A — The progressive decrease in RER from 0.85 to 0.78 during 3 hours of cycling reflects increasing reliance on fat oxidation as muscle glycogen stores deplete. As carbohydrate availability declines, the body shifts progressively toward fat as the dominant substrate, producing the lower CO_2-to-O_2 ratio characteristic of fat metabolism.

46. C — The Cori cycle recycles lactate into glucose, helping maintain blood glucose levels during sustained exercise. This pathway is particularly important because the brain is obligatorily glucose-dependent and the working muscles benefit from continued glucose availability as local glycogen stores become depleted.

47. A — PCr resynthesis requires 3-5 minutes for near-complete restoration. Without adequate PCr, subsequent sprints rely increasingly on glycolysis, producing hydrogen ions that cause fatigue and reduce sprint quality. The extended rest preserves the phosphagen-dominant energy contribution needed for maximal-quality sprint repetitions.

48. D — At approximately 90 degrees of elbow flexion with horizontal forearms, the perpendicular distance from the barbell's gravitational force line to the shoulder joint axis is at or near maximum. Because torque = force × moment arm, this position creates the greatest torque demand on the shoulder musculature.

49. B — In second-class levers, the effort arm is longer than the resistance arm, creating a mechanical advantage greater than one. This means the muscle can produce movement against a greater external resistance with less force than would be required in a third-class lever arrangement. The calf raise exemplifies this force-favoring arrangement.

50. C — Passive ROM exceeds active ROM because external force can move the joint beyond the point where voluntary muscular effort can produce or control movement. The 15-degree difference reflects the neuromuscular and motor control limits of active motion — the muscles cannot generate enough force or coordination to actively move the joint through the full passive range.

51. A — The stretch reflex (myotatic reflex) is a monosynaptic reflex arc in which muscle spindle afferents synapse directly on alpha motor neurons innervating the same muscle. During plyometric landing, the rapid eccentric stretch activates this reflex, producing a rapid protective contraction that augments the subsequent concentric force production during the SSC.

52. D — The law of diminishing returns explains that after capturing the easily accessible neural adaptations (Weeks 1-8) and initial structural adaptations (Weeks 9-16), the rate of improvement naturally decelerates. Further progress requires progressively greater training specificity, variation, and programming sophistication to produce smaller incremental gains.

SPORT PSYCHOLOGY (Questions 53–75)

53. B — Racing thoughts, worry about mistakes, and fear of disappointing coaches are cognitive anxiety symptoms — the mental component of competitive anxiety characterized by negative thought patterns, worry, and fear of failure. Cognitive anxiety requires cognitive interventions (thought stopping, self-talk replacement) rather than physical relaxation techniques.

54. C — Precision archery requires steady hands, focused concentration, and fine motor control — all degraded by excessive arousal. The optimal arousal level is relatively low because high activation causes muscle tremor, attentional narrowing, and impaired fine coordination that degrade the accuracy required for precision shooting.

55. C — The hierarchical combination is most effective: outcome goals provide long-term direction and motivation, performance goals provide measurable benchmarks for tracking progress, and process goals direct daily attention to controllable behaviors. This three-level structure connects daily actions to long-term competitive aspirations.

56. A — Self-efficacy is task-specific and situation-specific — an athlete may 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. Self-efficacy changes based on experience, mastery, and context.

57. B — The pattern of excellent practice performance with competitive underperformance, combined with intense worry, negative self-talk, and focusing difficulties, indicates choking under pressure. Excessive cognitive anxiety disrupts the automatic motor execution of well-learned skills that the athlete demonstrates in low-pressure practice.

58. C — Somatic anxiety symptoms (muscle tension, elevated heart rate, rapid breathing) require physical relaxation techniques that directly address the physiological activation. Progressive muscle relaxation teaches systematic tension release, and diaphragmatic breathing activates the parasympathetic nervous system to reduce cardiovascular activation.

59. D — Effective mental imagery engages visual (ball trajectory), kinesthetic (shooting motion feel), auditory (ball swishing through net), and emotional (confidence of success) components simultaneously. Multi-sensory rehearsal creates richer, more vivid mental representations that transfer more effectively to actual performance.

60. A — The associative stage is characterized by smaller, less frequent errors compared to the cognitive stage, with the developing ability to self-detect and self-correct some mistakes. The

athlete understands the basic movement pattern and is refining it through practice, but execution is not yet automatic.

61. B — Random practice produces slower initial improvement because task-switching disrupts immediate performance, but significantly better long-term retention because the deeper cognitive processing forced by constant switching builds more robust motor program representations. Blocked practice shows the opposite pattern.

62. D — The guidance hypothesis establishes that constant external feedback creates dependency — the athlete learns to rely on the coach's correction rather than developing internal error-detection capabilities. Reducing feedback frequency forces the athlete to attend to their own sensory information, producing more self-sustaining long-term skill.

63. C — "Your front knee collapsed inward" describes the quality of the movement pattern itself — how the technique was executed. This is knowledge of performance (KP), which is more useful for skill correction than knowledge of results (KR, which would describe the outcome such as reps completed or weight lifted).

64. A — Memory consolidation during rest intervals is the neurological process of stabilizing and transferring motor memories from short-term to long-term storage. Distributed practice allows this process to occur between bouts, producing more durable motor representations that resist forgetting and transfer better to novel situations.

65. B — The front squat develops the upright torso, high-elbow rack position, and deep receiving posture that directly transfer to the power clean catch. Shared movement features between the two exercises create positive transfer — practice on one directly improves performance on the other.

66. D — Progressive withdrawal, persistent loss of motivation, feeling trapped, and emotional exhaustion over several weeks are hallmarks of athletic burnout. The three dimensions — emotional exhaustion, depersonalization (cynicism toward the sport), and reduced sense of accomplishment — distinguish burnout from acute anxiety or normal mood fluctuation.

67. A — Increasing withdrawal, persistent feelings of worthlessness, loss of interest, and hopelessness are potential warning signs of clinical depression requiring professional evaluation. The strength and conditioning specialist should recognize these signs and recommend that parents seek assessment from a qualified mental health professional.

68. C — Extreme weight manipulation, meal avoidance, excessive exercise, and body weight preoccupation are warning signs of disordered eating requiring professional evaluation. Diagnosing and treating eating disorders is outside the CSCS scope of practice — the specialist must refer to a qualified healthcare provider.

69. B — Removing athlete input violates autonomy, providing no positive feedback undermines competence, and isolating underperformers destroys relatedness. All three basic psychological

needs are simultaneously violated, directly undermining intrinsic motivation — the most sustainable and performance-enhancing form of motivation.

70. D — RED-S in male athletes produces suppressed testosterone, decreased bone mineral density, impaired immune function, and declining performance. Chronic low energy availability drives these consequences regardless of sex, expanding beyond the original female athlete triad to include all athletes with energy deficiency.

71. A — Past performance accomplishment is the most powerful source of self-efficacy. Successfully completing 180 kg provides direct personal evidence that the athlete can lift at this level, creating the strongest possible confidence that 185 kg is achievable. Mastery experience surpasses all other efficacy sources.

72. C — Scanning the entire court to identify defensive coverage and open teammates requires broad-external attentional focus — perceiving multiple stimuli across a wide visual field simultaneously. This broad scanning precedes narrowing to a specific target when the play develops.

73. D — The absolute speed and force of the throw change between the fastball and changeup, but the invariant features (relative timing, relative force proportions, spatial pattern) of the throwing GMP remain constant. This is the functional advantage of generalized motor programs — adaptability through variable parameter adjustment.

74. D — Fear of re-injury is a recognized psychological barrier to return from ACL surgery. Gradually reintroducing movements at progressive intensities builds physical confidence through mastery, while sport psychology referral addresses the cognitive and emotional components through evidence-based interventions like graded exposure and cognitive restructuring.

75. A — Research consistently demonstrates that psychological distress during rehabilitation — fear, frustration, depression, isolation — produces longer recovery timelines and higher re-injury rates. Psychological factors significantly influence rehabilitation outcomes, underscoring the need for comprehensive psychological support during the return-to-play process.

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 protein synthesis, tissue repair, and anti-catabolic demands of heavy resistance training adaptation.

77. D — Leucine is the branched-chain amino acid identified as the primary trigger for mTOR pathway activation, initiating muscle protein synthesis. A threshold dose of approximately 2-3 grams of leucine per meal ensures optimal stimulation of the protein synthetic machinery.

78. C — Chronically inadequate dietary fat (below 15-20% of calories) impairs steroid hormone production because cholesterol is the precursor for testosterone synthesis. Fat-soluble vitamins (A,

D, E, K) also require dietary fat for intestinal absorption. Both consequences compromise health and training adaptation.

79. A — Consuming 2.5 liters per hour of plain water for 4 hours without sodium replacement dilutes blood sodium concentration below safe levels. The massive fluid intake relative to sodium losses through sweat reduces serum sodium dangerously, causing the confusion and disorientation characteristic of exercise-associated hyponatremia.

80. B — The maintenance-only approach (3-5 g/day without loading) achieves full intramuscular creatine saturation in approximately 28 days. This is equally effective as the loading protocol — it simply takes longer to reach the same saturated endpoint through gradual daily accumulation.

81. D — A 75 kg athlete at 3 mg/kg requires 225 mg of caffeine (75 × 3 = 225). This represents the lower end of the effective ergogenic dose range, approximately equivalent to 2-3 cups of brewed coffee consumed 30-60 minutes before exercise.

82. C — Carnosine buffers hydrogen ions during high-intensity exercise. This buffering is most beneficial during activities lasting 1-4 minutes where glycolytic hydrogen ion accumulation is the primary performance limiter. Activities shorter than this rely on the phosphagen system, and longer activities are primarily aerobic.

83. A — NSF Certified for Sport and Informed Sport independently test supplement products for banned substances, verify label accuracy, and screen for undeclared ingredients. These third-party certifications provide the most reliable protection against inadvertent positive drug tests under WADA regulations.

84. B — During caloric deficit, protein needs increase to 2.0-2.4 g/kg/day to maximize lean mass preservation. The elevated intake combined with continued resistance training provides maximum defense against the muscle catabolism that accelerates during energy restriction.

85. D — Gastrointestinal distress — nausea, bloating, cramping, and diarrhea — is the most common side effect limiting sodium bicarbonate tolerability. The alkaline nature of the compound and the large dose required (0.2-0.3 g/kg) can significantly irritate the GI tract, causing symptoms that may impair rather than enhance performance.

86. C — An 80 kg athlete at 10 g/kg/day requires 800 grams of carbohydrate daily (80 × 10 = 800). This upper-end recommendation supports the extreme glycogen demands of high-volume endurance training with daily depletion and replenishment cycles.

87. A — Vitamin D deficiency produces impaired muscle function (reduced strength and power), compromised immune competence (increased illness susceptibility), and elevated stress fracture risk with decreased bone mineral density. Athletes training indoors or at northern latitudes have the highest deficiency risk.

88. B — Vitamin C converts ferric iron (Fe^{3+}) to the more bioavailable ferrous form (Fe^{2+}), enhancing intestinal absorption of non-heme iron from plant-based sources. This is especially important for athletes with low ferritin who depend on plant-based iron with lower baseline bioavailability.

89. D — When rapid glycogen recovery is essential (two sessions within 8 hours), consuming 1.0-1.5 g/kg of carbohydrate within 30 minutes capitalizes on maximal glycogen synthase activity. This enzyme is most active immediately post-exercise, and early carbohydrate intake maximizes glycogen resynthesis rate.

90. C — Plant-based athletes achieve adequate essential amino acid intake by consuming a variety of complementary protein sources throughout the day. Grains are low in lysine but high in methionine, while legumes have the opposite profile — combining multiple sources provides all essential amino acids.

91. A — Casein protein forms a gel in the stomach that slows digestion, providing sustained amino acid delivery throughout the 7-9 hour overnight fasting period. This sustained release supports muscle protein synthesis during sleep when no other protein intake occurs.

92. B — High-GI foods produce rapid blood glucose spikes and are most appropriately consumed during and immediately after exercise when rapid glucose delivery and glycogen replenishment are the priorities. The fast absorption rate matches the acute metabolic needs of the peri-exercise window.

93. D — Glutamine has limited evidence for muscle growth in healthy, well-nourished athletes with adequate protein intake. It is not classified among supplements with robust ergogenic evidence (creatine, caffeine, beta-alanine, sodium bicarbonate) for performance enhancement or hypertrophy.

94. C — Fat is essential for steroid hormone production (testosterone requires cholesterol), fat-soluble vitamin absorption (A, D, E, K require dietary fat for transport), cell membrane integrity (phospholipid bilayer structure), and provision of essential fatty acids (linoleic and alpha-linolenic) that the body cannot synthesize.

95. A — Fluid intake of approximately 200-300 mL every 15-20 minutes helps prevent body weight loss exceeding 2%, where performance impairments become measurable. Individual adjustment based on sweat rate, environmental conditions, and sport-specific drinking opportunities optimizes the hydration strategy.

SECTION 2 — PRACTICAL/APPLIED

EXERCISE TECHNIQUE (Questions 96–140)

96. D — Before loading any barbell exercise, each athlete should demonstrate an unloaded bodyweight squat to assess ankle dorsiflexion, hip flexion, thoracic extension, knee tracking, and

spinal neutrality. This screening identifies mobility restrictions and motor control deficiencies requiring correction before external load is added.

97. B — Heels rising during the squat indicates insufficient ankle dorsiflexion — the tibia cannot translate forward adequately to maintain balance with the heels grounded. The body compensates by shifting weight to the toes. Ankle mobility work, elevated heels, or weightlifting shoes can address this limitation.

98. C — Forward bar drift increases the horizontal distance from the bar to the lumbar spine, creating a larger moment arm. Because torque = force × moment arm, this increased distance dramatically amplifies the flexion torque the erector spinae must resist, elevating lumbar injury risk substantially.

99. A — An open (false) grip allows the bar to roll out of the hands onto the chest, neck, or face — a potentially catastrophic event. A closed grip with thumbs wrapped around the bar creates a mechanical lock that prevents this uncontrolled bar displacement. This is a non-negotiable safety requirement.

100. D — Excessive lumbar hyperextension under load creates compressive and shear forces on the lumbar vertebrae, discs, and facet joints while shifting the exercise toward an incline press pattern. This compensation indicates the load exceeds the athlete's strict pressing capacity.

101. B — The NSCA's top-down progression begins with the front squat to establish the receiving position — comfort with the bar on the anterior deltoids, high-elbow rack position, and upright torso — before introducing any pulling phases. This ensures safe bar reception before explosive pulling is taught.

102. C — Premature arm bending during the second pull substitutes arm strength for the more powerful hip extensors. The arms should remain straight, transmitting the force from explosive triple extension to the bar. Pulling with the arms limits bar velocity and the maximum weight that can be cleaned.

103. D — Ground contact times doubling from 170 to 360 ms with declining jump height indicates fatigue and loss of SSC effectiveness. Plyometric training is quality-based — continuing degraded repetitions trains poor movement patterns. The exercise should be terminated immediately.

104. A — Novice athletes should begin with low-to-moderate intensity plyometrics (squat jumps, CMJ, box jumps stepping down) at 80-100 foot contacts per session. High-intensity exercises and excessive volumes are inappropriate without the connective tissue conditioning and movement competency developed through progressive experience.

105. B — A single back squat spotter positions behind the athlete with arms extending under the armpits to assist the athlete upward at the torso. The spotter never grips the bar — this could create asymmetric loading. Torso assistance supports the athlete's body rather than the external load.

106. C — The Valsalva maneuver is appropriate for healthy, trained athletes performing heavy compound lifts where maximal intra-abdominal pressure provides essential spinal stabilization. It is contraindicated for individuals with cardiovascular risk factors where extreme blood pressure spikes pose danger.

107. D — Significant spinal rounding with momentum indicates excessive load and dangerous technique. The set must be terminated, load reduced, and the athlete cued to maintain a rigid neutral spine with pulling initiated by scapular retraction. Momentum-based rowing bypasses the target muscles and risks spinal injury.

108. A — A baseball pitcher needs rotational power (medicine ball rotational throws) for the throwing motion and anti-rotation stability (Pallof press) for deceleration and spinal protection. This combination addresses both the force-producing and force-resisting demands of pitching.

109. B — Anti-extension exercises train the core to resist lumbar hyperextension as gravity or external load pulls the lumbar spine into an arched position. The ab wheel rollout challenges the rectus abdominis and deep stabilizers to maintain spinal neutrality against this extending force.

110. C — Running upright during acceleration directs forces too vertically, reducing the horizontal component needed to overcome inertia. The forward lean allows horizontal force application against the ground, generating the forward-directed reaction force essential for rapid acceleration.

111. D — The pro agility shuttle uses a preplanned movement pattern. True agility requires a reactive perceptual-cognitive component — perceiving, processing, and responding to unpredictable stimuli while executing direction changes. This decision-making element defines true agility.

112. A — Dynamic stretching increases ROM while activating the neuromuscular system through active muscle engagement. Static stretching before explosive activity acutely reduces force production and power by decreasing musculotendinous stiffness and neural activation.

113. C — Foam rolling increases range of motion without the acute decrements in force and power associated with static stretching. This makes it a preferred pre-training tool that enhances flexibility while preserving the muscular readiness needed for explosive performance.

114. B — The correct warmup sequence progresses: general warmup (low-intensity activity) → dynamic stretching (session-specific movements) → movement preparation (activation drills) → specific warmup (progressive loading in training exercises). This general-to-specific progression optimizes readiness.

115. D — Chronic CWI after resistance training may blunt the inflammatory signaling cascades (prostaglandins, cytokines, satellite cell activation) necessary for muscle protein synthesis and tissue remodeling. The acute inflammation is part of the adaptive response — chronically suppressing it may impair hypertrophy and strength gains.

116. A — Sleep (7-10 hours nightly) and post-exercise nutrition (protein for repair, carbohydrate for glycogen) are the foundational recovery practices with the strongest evidence base. No external modality can compensate for deficits in these non-negotiable biological requirements.

117. C — Basketball's diverse demands require aerobic base training (sustained 48-minute play), anaerobic interval training (repeated court-length sprints with sport-specific rest), and reactive agility conditioning (direction changes in response to unpredictable game situations).

118. B — The aerobic system's most important team sport contribution is recovery capacity. Between high-intensity efforts, the aerobic system replenishes PCr, clears lactate and hydrogen ions, and restores homeostasis. Superior aerobic fitness enables faster recovery and sustained performance across repeated bouts.

119. D — A defensive back performing 4-6 second sprints with 25-40 seconds rest operates at approximately 1:5 to 1:7, targeting the phosphagen system with near-complete PCr recovery. This matches the sport-specific energy demand pattern.

120. A — Active recovery at low intensity promotes blood flow to recovering tissues, facilitating nutrient and oxygen delivery while assisting metabolic waste removal. This circulatory benefit is the primary mechanism by which active recovery may improve subjective recovery compared to complete rest.

121. C — Dropped elbows during the front squat cause the bar to lose its shelf on the anterior deltoids and roll forward. This creates loss of control, excessive wrist and elbow stress, and forward center of gravity shift. High elbows are essential for safe front squat execution.

122. B — Stepping backward eliminates the eccentric deceleration demand on the front leg that occurs during forward lunging. The front leg remains relatively stationary with a more vertical shin, reducing the shear forces on anterior knee structures that contribute to patellofemoral pain.

123. D — Moving the front foot further from the bench creates a more vertical shin angle, reducing forward knee translation. This shifts primary loading from the knee extensors to the hip extensors (glutes, hamstrings), decreasing the shear forces on the anterior knee that cause the reported strain.

124. A — The hex bar centers the load at the athlete's sides rather than in front of the body, reducing the horizontal distance between the load and the lumbar spine. This shorter moment arm decreases the flexion torque and spinal loading compared to the conventional barbell deadlift.

125. C — Dumbbell exercise spotting should occur at the wrists near the athlete's hands. Spotting at the elbows creates a dangerous fulcrum effect, and the dumbbells themselves may move independently. Wrist contact allows effective directional guidance of the load.

126. B — Bands provide minimum resistance at the bottom (least stretched) and maximum at the top (fully stretched). This challenges the athlete most in the mechanically strongest lockout position where free weights become relatively easy, training force production through the complete ROM.

127. D — A medicine ball throw qualifies as plyometric only when executed with maximal speed and minimal transition between the eccentric catch and concentric throw. This rapid SSC execution stores and returns elastic energy and activates the stretch reflex. Paused or slow throws eliminate these mechanisms.

128. A — Olympic platforms must be separated from traffic areas with adequate clearance on all sides for dropped barbells and failed lifts. Athletes and staff should never be within the impact zone during Olympic lifting. This clearance is the primary safety consideration.

129. C — Groups of 3 per rack create efficient rotation: one squats, one spots, one rests. This maintains continuous workflow, ensures every athlete has a dedicated spotter, and keeps all 30 athletes productively engaged with appropriate supervision.

130. B — Collars prevent plates from sliding off barbell ends during exercise. Without collars, plates can shift from uneven pressing, racking, or balance loss, causing sudden asymmetric loading that may result in loss of control, dropped weights, or injury.

131. D — The power snatch is the explosive exercise requiring the highest neuromuscular coordination and must be performed first when the athlete is freshest. All subsequent exercises follow in descending order of technical and neuromuscular demand.

132. A — A single bench press spotter uses an alternated grip (one pronated, one supinated) close to center for maximum grip security and symmetric upward force application. This positioning behind the head allows the spotter to assist smoothly without interfering with the athlete's pressing mechanics.

133. C — Slight constant knee flexion, neutral spine, hip hinge, and bar close to the legs represent correct RDL technique. The RDL is a hip-dominant exercise targeting the hamstrings and glutes through controlled eccentric hip flexion and concentric extension.

134. B — Pull-ups and lat pulldowns develop pulling strength for the swim stroke. Internal/external rotation exercises protect the rotator cuff from repetitive overuse injury. Core anti-rotation work develops trunk stability for force transfer during swimming.

135. D — The Pallof press trains the core to resist rotational force — an external load attempts to twist the torso while the athlete maintains neutral trunk alignment. This anti-rotation function develops spinal stability during athletic movements involving rotational forces.

136. A — The snatch requires receiving the bar overhead with locked arms in a deep squat. Overhead squat mobility assessment verifies the ability to maintain a stable locked-arm overhead position while squatting to full depth with an upright torso — the essential positional prerequisite.

137. C — Correct push-up technique: straight line from head to heels with core braced, chest touches or nearly touches the floor at the bottom, and elbows track at approximately 45 degrees from the torso. This maximizes training stimulus while protecting the shoulder.

138. B — Face pulls at face height with external rotation and scapular retraction target the posterior deltoids, infraspinatus, teres minor, and middle trapezius. These muscles are critical for shoulder health and postural balance in athletes who perform heavy pressing.

139. D — Sprint intervals of 5-10 yards with 25-40 seconds rest replicate the lineman's phosphagen-dominant demands at the sport-specific work-to-rest ratio. This ensures conditioning adaptations transfer directly to the repeated short-burst pattern of offensive line play.

140. A — Correct overhead press grip positions the forearms approximately vertical at shoulder height with wrists directly above elbows. This alignment directs force vertically through the strongest mechanical position and minimizes lateral stress on the wrists and elbows.

PROGRAM DESIGN (Questions 141–184)

141. C — The 100-meter sprint (10-12 seconds at maximal effort) falls within the phosphagen system's dominant duration range. The phosphagen system provides the fastest ATP regeneration rate for this brief, maximal-effort event. The glycolytic system contributes increasingly toward the finish but is not the primary contributor.

142. D — A power exercise must be structural (loads the spine), performed explosively (rapid force production), and involve large muscle masses. The power clean meets all criteria: it loads the spine, requires maximal-velocity triple extension, and involves the entire kinetic chain from ankles through shoulders.

143. B — The hang clean is the power/explosive exercise requiring the highest neuromuscular coordination and must be performed first. The remaining exercises follow: core multi-joint (squat, bench) → assistance (lat pulldown, lateral raise) → core stability (side plank).

144. A — Novice athletes benefit from 2-3 total-body sessions per week with moderate loads, higher repetitions, and technique emphasis. This frequency provides adequate stimulus while allowing recovery for the rapid neural and structural adaptations characteristic of early training responses.

145. C — Training at 67-85% 1RM for 6-12 repetitions with 30-90 seconds rest targets muscle hypertrophy. This zone provides mechanical tension for growth, and the short rest maintains the metabolic stress and hormonal environment that support the hypertrophic stimulus.

146. D — 85% of 170 kg = 144.5 kg, rounded to approximately 144-145 kg per working set. Five sets of 4 at this load with 3-minute rest represents a heavy strength protocol targeting neural adaptation through near-maximal motor unit recruitment.

147. B — Rest periods of 2-5 minutes for maximal strength and power allow adequate phosphocreatine resynthesis and neural recovery. This ensures the athlete can produce maximal force on every subsequent set — the essential stimulus for strength adaptation.

148. A — DUP's primary advantage is more frequent exposure to different stimuli within each week. Cycling through hypertrophy, strength, and power sessions provides regular stimulus for all three

qualities, potentially preventing accommodation while enabling simultaneous multi-quality development.

149. C — Linear periodization progressively increases intensity while decreasing volume across sequential mesocycles. The typical sequence moves from high-volume/moderate-intensity through moderate-volume/high-intensity to low-volume/very-high-intensity peaking.

150. D — Block periodization sequences: accumulation (high volume, moderate intensity for work capacity) → transmutation (higher intensity for sport-specific adaptation) → realization (low volume for peaking). Each block concentrates on targeted qualities that build upon the preceding block's adaptations.

151. B — Maintaining intensity at preparatory-period levels while reducing volume and frequency preserves the neural and muscular stimulus for strength maintenance. Research consistently shows intensity is the most critical variable — volume and frequency can be reduced without detraining.

152. A — The transition period lasts 2-4 weeks of unstructured, low-intensity active recovery. This provides physical restoration, psychological renewal, minor injury treatment, and motivation restoration before the next annual training cycle begins.

153. C — Jump squat peak power occurs at 0-30% of back squat 1RM where lighter loading allows the high velocities needed to maximize the velocity component of the power equation. Heavier loads increase force but reduce velocity below the threshold for peak power.

154. D — The hang clean achieves peak power at 70-80% of 1RM because sufficient mass is needed for meaningful force production while velocity remains high enough for peak power expression. The ballistic nature of the clean means the load is accelerated throughout the full ROM.

155. B — Beginner athletes start with 80-100 foot contacts per session across exercises of varying intensity. This volume provides initial stimulus while protecting musculotendinous structures not yet conditioned for the eccentric demands of plyometric training.

156. A — Plyometrics should be performed after warmup when fresh for maximal effort and proper technique. Fatigue from prior exercise degrades explosive output and compromises landing mechanics, reducing training quality and increasing injury risk.

157. C — High squat (88th percentile) with low vertical jump (32nd percentile) indicates a rate of force development deficit — adequate maximal strength but poor ability to express it rapidly. Explosive training (plyometrics, Olympic lifts, jump squats) develops rapid force production.

158. D — Soccer's 90-minute mixed demands require aerobic base (sustained play), anaerobic intervals (repeated sprints with sport-specific rest), and reactive agility (direction changes responding to opponents). Each component addresses a specific physical demand of the sport.

159. B — The transition period provides 2-4 weeks of physical and psychological recovery, minor injury treatment, and motivation restoration. The unstructured, low-intensity approach allows complete restoration before the next preparatory period begins.

160. B — Return to play requires bilateral symmetry within 10%, sport-specific movement competency, and medical clearance. Objective criteria reduce reinjury risk associated with persistent strength and functional asymmetries that subjective assessment cannot detect.

161. D — Hockey shifts of 45-60 seconds with 2-3 minutes rest represent glycolytic-dominant demands. Training with matching interval durations and rest periods targets the glycolytic system specifically for the most transferable conditioning adaptation.

162. C — An advanced athlete with 7 years of experience preparing for a single competition requires block periodization's concentrated, targeted stimuli. Accumulation → transmutation → realization provides precise control with the final block timed for peak performance.

163. A — The principle of accommodation predicts diminished response to a constant stimulus over time. Introducing variation in exercises, loads, volumes, or periodization model provides novel stimuli that overcome the plateau and resume progress.

164. B — Hamstring reconditioning progresses from low-intensity exercises through progressive resistance through sport-specific movements, with objective bilateral symmetry (within 10%) required before unrestricted return. Each stage builds upon the previous with objective criteria gating advancement.

165. D — Block periodization for powerlifting: accumulation (high volume for structural development) → transmutation (higher intensity for sport-specific strength) → realization (low volume for peaking at competition). Each block builds upon the preceding adaptations.

166. C — Muscular endurance training uses 30 seconds or less of rest to maintain elevated metabolic demand throughout the session. Short rest prevents full recovery, forcing muscles to sustain work under fatigue — the specific adaptation being developed.

167. A — Five sets of 2 at 93% 1RM with 5-minute rest develops maximal strength through neural adaptation. Near-maximal loading recruits the highest-threshold motor units, and complete recovery ensures maximal force production on every repetition.

168. B — Volume load = 4 × 8 × 110 = 3,520 kg. This standard calculation quantifies total training work for tracking progressive overload, comparing training phases, and managing fatigue accumulation across the program.

169. D — Five sets of 5 at 85% 1RM with 3-minute rest is a heavy strength protocol. The high intensity recruits high-threshold motor units, and the adequate rest supports neural recovery for maximal force on each set.

170. C — General preparation builds a broad foundation of hypertrophy, general strength, work capacity, and aerobic fitness. This base supports the more specific, intense training during subsequent specific preparation.

171. A — Specific preparation shifts emphasis to sport-specific qualities: power, speed, agility, and sport-specific conditioning. Exercise selection becomes more targeted, and methods more closely replicate competitive demands.

172. B — Three progressive weeks (38K → 42K → 46K) followed by a reduced week (28K) represents a deload designed to manage accumulated fatigue while preserving adaptation before the next loading cycle.

173. D — Six-second sprints with 90-second rest (approximately 1:15) target the phosphagen system with near-complete PCr recovery. The short work duration is phosphagen-dominant, and the generous rest allows adequate resynthesis for maximal repeated efforts.

174. C — An athlete explosive on the field but struggling with heavy lifts has a maximal strength deficit. Their power expression outpaces their force capacity. Heavy resistance training (85%+ 1RM) builds the larger force foundation from which greater explosive power can be expressed.

175. A — Novice athletes benefit from moderate loads (60-70% 1RM) with higher repetitions (10-15) during the first 4-6 weeks. This develops technique proficiency, builds work capacity, allows connective tissue adaptation, and establishes the foundation for heavier loading.

176. B — The 48-72 hour requirement allows adequate recovery of musculotendinous structures experiencing significant eccentric loading during plyometrics. Tendons adapt more slowly than muscle and require longer recovery to prevent overuse injury.

177. D — Combining heavy training (85%+ 1RM) with explosive exercises (Olympic lifts, plyometrics, jump squats at 30-50% 1RM) addresses both ends of the force-velocity continuum. Heavy loads develop maximal force; explosive exercises develop high-velocity power.

178. C — Three-minute fighting rounds fall within the glycolytic-dominant range. The glycolytic system provides primary ATP during each round, supplemented by the phosphagen system for explosive techniques and the aerobic system for between-round recovery.

179. A — Training intensity (percentage of 1RM) is the most critical variable for preventing in-season detraining. Volume and frequency can be reduced substantially while maintained intensity preserves the neural and muscular adaptations underpinning strength.

180. B — The correct annual sequence: general preparation (broad fitness base) → specific preparation (sport-specific qualities) → competition (peaking and maintenance) → transition (recovery). Each period builds upon the preceding one.

181. D — Pull-ups and rows for pulling strength, dead hangs and farmer's carries for grip endurance, anti-extension/anti-rotation core exercises for stability, and nutritional guidance for body composition directly address all identified climbing needs.

182. C — DUP provides more frequent exposure to different stimuli within each week. Cycling through hypertrophy, strength, and power prevents accommodation to any single training zone while enabling simultaneous multi-quality development.

183. A — Belt squats, leg press, goblet squats with modified grip, and other exercises bypassing conventional barbell grip maintain lower body training while accommodating the wrist injury. Eliminating all training causes unnecessary detraining.

184. B — A goalkeeper's explosive saves and short sprints (2-5 seconds) are phosphagen-dominant. Work-to-rest ratios of 1:8 to 1:12 allow near-complete PCr recovery, enabling maximal quality on each explosive effort — matching the variable, explosive demands of the position.

TESTING AND EVALUATION (Questions 185–206)

185. D — The vertical jump (CMJ) using a Vertec is valid, reliable, practical for 45 athletes in 90 minutes, and directly measures lower body explosive power in a sport-relevant movement. Multiple athletes can be tested efficiently with a single device.

186. A — Reliability is consistency and reproducibility across repeated administrations under identical conditions. High reliability ensures that observed score changes reflect true performance improvement rather than measurement variability from inconsistent testing procedures.

187. C — The 1RM is the last weight successfully lifted with acceptable technique through the full ROM. The athlete completed 130 kg but failed at 135 kg, so 130 kg is the recorded 1RM. Failed attempts are never counted.

188. B — The 11 cm difference between CMJ (62 cm) and SJ (51 cm) reflects stretch-shortening cycle utilization. The countermovement stores elastic energy and activates the stretch reflex, contributing additional force during the concentric phase unavailable in the static jump.

189. D — Electronic timing eliminates the human timer's reaction time variability (approximately 0.1-0.3 seconds per measurement). In short sprints, this error represents a substantial proportion of total time and can obscure real performance differences between athletes.

190. A — The two-step calculation: (1) skinfold thicknesses enter population-specific prediction equations to estimate body density, then (2) body density converts to body fat percentage using equations such as the Siri formula. Both steps are required.

191. C — BIA accuracy is most significantly affected by hydration status, which alters electrical conductivity. Dehydration overestimates body fat; hyperhydration underestimates it. Consistent hydration across sessions is essential for reliable longitudinal comparisons.

192. B — A 19% asymmetry substantially exceeds the 10-15% clinical threshold, warranting targeted corrective programming emphasizing the weaker leg and possible medical evaluation to identify underlying pathology or rehabilitation deficiency.

193. D — The vertical jump (33rd percentile) is disproportionately low relative to the 85th percentile squat, indicating a rate of force development deficit. Explosive training (plyometrics, Olympic lifts, jump squats) should receive highest programming priority.

194. A — Identical testing conditions across sessions — same warmup, equipment, test order, time of day, environment — is the most critical factor for valid comparisons. Any variation between sessions may be incorrectly interpreted as performance changes.

195. C — At 89%, the surgical leg hasn't met the 90% symmetry threshold required for return consideration. Continued progressive strengthening should bring the surgical leg to the criterion, reducing the reinjury risk associated with persistent asymmetry.

196. B — Normative data must match sport, competitive level, age, and sex for meaningful percentile rankings. Inappropriate reference populations produce misleading rankings that do not reflect the athlete's true standing among their peers.

197. D — Force plates measure peak GRF, rate of force development, impulse, and power output in addition to jump height. This comprehensive data enables detailed biomechanical analysis impossible with simpler methods.

198. A — The sit-and-reach primarily measures hamstring and lower back flexibility, does not assess other joints, and is influenced by limb proportions. For joint-specific assessment, goniometry provides more diagnostic information.

199. C — Goniometry provides joint-specific ROM measurements at any individual joint, identifying specific restrictions that the sit-and-reach cannot detect. This specificity allows targeted identification of the exact joint or tissue limiting movement.

200. B — Testing at the beginning and end of each major phase and at pre/post-season provides sufficient data for progress tracking and program evaluation without excessive training disruption.

201. D — Prediction equations are most accurate with 10 or fewer repetitions because the rep-to-1RM relationship becomes less linear at higher counts. Muscular endurance, motivation, and pain tolerance introduce variability not captured by the equations.

202. A — The standardized protocol includes 3-4 progressively heavier warmup sets (approximately 50%, 70%, 80-85% of estimated 1RM) before maximal attempts. This progressive loading prepares the neuromuscular system at incrementally higher intensities.

203. C — The T-test includes forward sprint, lateral shuffle in both directions, and backward run in a T-shaped pattern. It assesses multidirectional movement ability including forward, lateral, and backward capabilities.

204. B — A squat at 1.1× body weight falls below the 1.5× threshold for plyometric effectiveness. Heavy resistance training develops the strength foundation that enables plyometrics to produce further power gains — without adequate strength, the SSC cannot be effectively loaded.

205. D — Both tests require athletes to self-pace at maximal effort, which depends on motivation, pacing experience, and discomfort tolerance. Athletes unfamiliar with maximal self-pacing may produce results that underestimate true aerobic capacity.

206. D — A comprehensive basketball battery should assess aerobic capacity, sprint speed, agility, lower body power, upper body strength, and body composition. These domains align with basketball's physical demands for endurance, explosiveness, and functional athleticism.

ORGANIZATION AND ADMINISTRATION (Questions 207–220)

207. C — Using the NSCA minimum: 50 × 40 = 2,000 sq ft. Using the upper guideline: 50 × 60 = 3,000 sq ft. The minimum is 2,000 square feet, with the upper guideline providing more comfortable spacing.

208. B — EAPs should be rehearsed at least annually with all staff, ideally more frequently. Unrehearsed plans fail under emergency stress because staff may not know roles, equipment locations, or communication procedures.

209. D — CPR and AED certification ensures every CSCS professional can provide immediate life-saving intervention for cardiac emergencies. Survival rates decline approximately 10% per minute without CPR and defibrillation.

210. A — The standard of care is the degree of care, skill, and diligence a reasonably competent professional with similar training would exercise under similar circumstances. It represents expected minimum competence, not perfection.

211. D — Waivers do not protect against recklessness or willful disregard for safety. While waivers document that inherent risks were disclosed and assumed, they cannot absolve professionals who demonstrate conduct beyond ordinary negligence.

212. B — Diagnosing conditions and prescribing rehabilitation are outside the CSCS scope. These require medical training and licensure. The specialist should refer to a physician, athletic trainer, or physical therapist for appropriate evaluation and treatment.

213. D — The CSCS scope encompasses designing periodized programs, teaching technique, administering performance tests, and managing the facility. Diagnosing injuries, prescribing rehabilitation, creating meal plans, and psychological counseling require separate credentials.

214. A — Damaged equipment must be immediately removed, tagged out of order, documented in maintenance logs, and repaired or replaced before return. Continued use violates the duty to maintain a safe environment.

215. C — The CSCS must decline unsafe practices, explain the evidence-based rationale, and advocate for athlete safety. The certified professional holds ultimate responsibility for the strength and conditioning program and cannot implement demands that violate safety standards.

216. B — Ratios should be adjusted based on exercise complexity (Olympic lifts need closer supervision), athlete experience (novices need more guidance), and staff qualifications (more qualified staff can manage larger groups). These factors collectively determine appropriate supervision.

217. D — Records should include training logs, testing data, waivers, medical clearances, equipment maintenance logs, and incident reports. These documents support programming decisions and provide legal protection demonstrating standard of care.

218. A — Unqualified instruction of technically demanding Olympic lifts to inexperienced athletes creates significant safety and liability risk. The concern must be addressed immediately through appropriate professional channels to protect athletes.

219. C — Footwear policies protect athletes from dropped weights and equipment. Open-toed sandals provide no protection. The policy must be enforced consistently — the athlete returns with proper closed-toe athletic shoes before training.

220. D — The NSCA professional standards establish that the CSCS holds ultimate professional authority and responsibility for the strength and conditioning program. While collaboration with sport coaches is essential, the certified professional makes final program decisions based on specialized expertise.