PRACTICE EXAM 5: CSCS FULL-LENGTH SIMULATION

SECTION 1 — SCIENTIFIC FOUNDATIONS

95 Questions | 1.5 Hours Recommended

EXERCISE SCIENCE (Questions 1–52)

1. A collegiate strength and conditioning specialist reviews two athletes' muscle biopsy data. Athlete X has 65% Type I fibers and 35% Type II fibers in the vastus lateralis. Athlete Y has 30% Type I and 70% Type II fibers. Based solely on fiber type distribution, which combination of sport pairing is most physiologically appropriate?

A. Athlete X is best suited for shot put; Athlete Y is best suited for marathon running

B. Both athletes are equally suited for all sports because fiber type has no relationship to performance

C. Athlete X is best suited for distance running; Athlete Y is best suited for sprinting

D. Athlete Y is best suited for endurance cycling; Athlete X is best suited for power events

2. An athlete performs a heavy 1RM deadlift. During the lockout, the lifter holds the weight motionless at full hip and knee extension for 3 seconds before returning the bar to the floor. During this 3-second hold, the hip extensors and erector spinae are performing which type of muscle action?

A. Eccentric because the muscles are actively lengthening under the load

B. Concentric because the muscles are actively shortening to complete the lockout

C. Isokinetic because the joint angle is changing at a constant velocity throughout the hold

D. Isometric because the muscles are generating force without any change in length to maintain the static lockout position

3. A sports medicine physician orders a muscle biopsy on a collegiate sprinter before and after a 20-week resistance training program. The pre-training biopsy shows 20% Type IIx fibers. The post-training biopsy shows only 5% Type IIx fibers with a corresponding increase in Type IIa fibers. Which statement best explains this fiber type shift?

A. The athlete lost Type IIx fibers through atrophy caused by excessive overtraining and muscle damage

B. Chronic resistance training promotes the transition of Type IIx fibers to the more fatigue-resistant Type IIa phenotype, which is the most well-documented fiber type conversion

C. The post-training biopsy was taken from a different muscle and therefore cannot be compared to the pre-training sample

D. Type IIx fibers converted directly to Type I fibers through a complete phenotypic transformation

4. During excitation-contraction coupling, calcium ions are released from the sarcoplasmic reticulum and bind to troponin C on the thin filament. This calcium-troponin interaction produces which immediate molecular event that enables contraction to proceed?

A. A conformational change in troponin that shifts tropomyosin away from the myosin binding sites on actin, allowing cross-bridge formation

B. Direct phosphorylation of the myosin heavy chain that energizes the myosin head for the power stroke

C. Hydrolysis of ATP within the sarcoplasmic reticulum membrane that releases additional calcium

D. Depolymerization of actin filaments that shortens the thin filament and narrows the I-band

5. A strength and conditioning specialist is evaluating two exercises for developing maximal force production in an athlete. Exercise A is a slow, heavy back squat at 90% of 1RM. Exercise B is a jump squat at 30% of 1RM. According to the force-velocity relationship, which exercise places the muscle closer to the maximum force end of the force-velocity curve?

A. Exercise B because lighter loads allow higher velocity which increases total force output

B. Both exercises produce identical force outputs because the same muscle groups are involved

C. Neither exercise can produce force above resting baseline because both involve concentric actions

D. Exercise A because higher loads at slower velocities allow more cross-bridges to form simultaneously and produce greater maximal force

6. A novice lifter begins a resistance training program and increases their squat 1RM by 40% in 6 weeks with no measurable change in thigh circumference. A trained lifter with 5 years of experience on the same program increases their squat 1RM by only 3% in the same 6 weeks but shows measurable hypertrophy on ultrasound imaging. What best explains this difference in adaptation patterns?

A. The trained lifter's body has completely stopped responding to resistance training after 5 years

B. The novice's rapid gains are neural (recruitment, rate coding, coordination) while the trained lifter's slower gains come from structural hypertrophy because their neural capacity is already near maximum

C. The novice is using performance-enhancing substances that the trained lifter is not

D. The trained lifter's muscles have become permanently resistant to all forms of adaptive stimulus

7. The all-or-none principle of motor unit activation states that when a motor neuron fires an action potential that reaches threshold, every muscle fiber within that motor unit contracts maximally. The nervous system grades total muscle force output from minimal to maximal through which two mechanisms?

A. Motor unit recruitment (activating more motor units) and rate coding (increasing the firing frequency of active motor units)

B. Varying the intensity of individual fiber contractions from partial to maximal within a single motor unit

C. Controlling the number of actin-myosin cross-bridges that form within each individual sarcomere

D. Adjusting the calcium concentration delivered to each individual fiber independently of all other fibers

8. An exercise physiologist administers a progressive treadmill test and measures ventilation continuously. At low and moderate intensities, ventilation increases proportionally with VO_2. At higher intensities, ventilation increases disproportionately, breaking from the linear relationship. This inflection point is called the ventilatory threshold. It closely corresponds to which metabolic event?

A. Complete depletion of intramuscular phosphocreatine stores during the progressive test

B. The point of maximal fat oxidation rate and the cessation of all carbohydrate metabolism

C. The lactate threshold, where blood lactate accumulation exceeds clearance capacity and the bicarbonate buffering system generates additional CO_2 that must be expelled

D. The deactivation of all Type II motor units and exclusive reliance on Type I fibers

9. An athlete performs repeated 10-second maximal sprints with only 20 seconds of rest between efforts. After 6 repetitions, sprint speed has declined by 25% from the first repetition. The primary metabolic explanation for this progressive performance decline is which of the following?

A. Complete glycogen depletion in the quadriceps and hamstrings after only 60 seconds of total work

B. Excessive oxygen delivery that has caused oxidative damage to the contractile proteins

C. Protein catabolism from amino acid deamination reducing available structural protein for contraction

D. Progressive phosphocreatine depletion — the 20-second rest allows only partial PCr recovery, so each successive sprint begins with less available PCr

10. A strength and conditioning specialist is programming conditioning for a wrestler whose matches consist of three 2-minute periods of sustained high-intensity grappling with brief rest between periods. The primary energy system that must be developed for performance during each 2-minute period is which of the following?

A. Exclusively the phosphagen system because individual wrestling techniques last less than 2 seconds each

B. The glycolytic system because 2-minute sustained high-intensity efforts fall within the glycolytic-dominant duration range

C. Exclusively the oxidative system because total match duration exceeds 5 minutes

D. None — energy system conditioning is irrelevant for combat sports

11. The complete aerobic metabolism of one molecule of palmitate (a 16-carbon fatty acid) through beta-oxidation, the Krebs cycle, and the electron transport chain yields approximately 129 ATP molecules. Despite this enormous energy yield, fat cannot serve as the dominant fuel during very high-intensity exercise because of which fundamental limitation?

A. The rate of ATP production from fat oxidation is too slow to match the rapid energy demand of high-intensity exercise, even though the total ATP yield per molecule is far greater than glucose

B. Fat stores are too small to provide meaningful energy for any type of exercise

C. Fat oxidation produces toxic metabolic waste products that impair muscle function during exercise

D. Fat molecules are too large to cross the mitochondrial membrane under any metabolic condition

12. During a graded exercise test, an athlete's blood lactate remains below 2 mmol/L from rest through 70% of VO_2max, then rises steeply to 4 mmol/L at 75% and 8 mmol/L at 85%. The intensity at which lactate began its exponential rise (approximately 70-75% VO_2max) represents which physiological marker?

A. The depletion of all intramuscular glycogen stores at this specific exercise intensity

B. The phosphocreatine recovery threshold below which PCr cannot regenerate during exercise

C. The lactate threshold — the intensity where lactate production begins to exceed clearance capacity

D. The VO_2max ceiling beyond which no further oxygen consumption is possible

13. A strength and conditioning specialist explains to an athlete that the Krebs cycle is a critical component of aerobic metabolism. The Krebs cycle occurs in which cellular compartment and produces which primary outputs that are subsequently used by the electron transport chain?

A. The Krebs cycle occurs in the sarcoplasm and directly produces 36 ATP molecules per glucose

B. The Krebs cycle occurs on the sarcolemma surface and produces phosphocreatine for rapid energy

C. The Krebs cycle occurs in the outer mitochondrial membrane and produces lactate as its final product

D. The Krebs cycle occurs in the mitochondrial matrix and produces NADH and $FADH_2$ (electron carriers) along with a small amount of ATP/GTP and CO_2

14. During prolonged exercise at moderate intensity (60% VO_2max) lasting 3 hours, the relative contribution of protein to total energy production is approximately 5% to 10% under normal conditions. Under which circumstance does protein's contribution to energy production increase substantially above this baseline?

A. When the athlete consumes excessive protein immediately before the exercise session begins

B. During glycogen-depleted states and prolonged exercise exceeding 90 minutes, when carbohydrate availability becomes limited and amino acid oxidation increases

C. Only during resistance training because protein is never oxidized for energy during aerobic exercise

D. Protein contribution decreases rather than increases during all forms of prolonged exercise

15. The phosphagen system regenerates ATP through two reactions: the creatine kinase reaction (PCr + ADP → ATP + Cr) and the myokinase (adenylate kinase) reaction (2 ADP → ATP + AMP). Which characteristic gives the phosphagen system its functional advantage for maximal-effort, short-duration activities?

A. It produces ATP at the fastest rate of any energy system because the reactions are simple, require no oxygen, and occur directly in the sarcoplasm without complex metabolic pathways

B. It has the greatest total energy capacity of all three systems and can sustain activity indefinitely

C. It produces no metabolic waste products and therefore causes no fatigue under any condition

D. It operates exclusively during low-intensity activities and is not activated during maximal efforts

16. A biomechanical analysis reveals that during a standing biceps curl with a 15 kg dumbbell, the biceps brachii must produce approximately 105 N of force at its insertion on the radial tuberosity to maintain the forearm in a static position at 90 degrees of elbow flexion. The 7:1 ratio between muscle force and external load exists because of which biomechanical factor?

A. The biceps is the weakest muscle in the body and requires disproportionate effort for all loads

B. The force ratio is always 1:1 because muscle force equals the external load at all joint angles

C. The distance from the elbow to the dumbbell is artificially shortened by the biceps tendon elasticity

D. The biceps inserts close to the elbow joint (short effort arm) while the dumbbell is held far from the joint (long resistance arm), creating a third-class lever with a mechanical disadvantage for force

17. An athlete performing a heavy back squat reaches the sticking point approximately 30 degrees above parallel during the ascent. At this joint angle, the moment arm of the barbell relative to the hip joint is near its maximum. A strength and conditioning specialist adds box squats to the program to specifically train through this sticking point. This intervention addresses which biomechanical limitation?

A. The athlete's ankle dorsiflexion range of motion limiting proper knee tracking during the descent

B. The athlete's grip strength limiting their ability to hold the bar on their back

C. The mechanical disadvantage created by the maximal moment arm at this specific joint angle, where the hip extensors must produce the greatest torque to continue the movement

D. The athlete's respiratory capacity limiting oxygen delivery to the working muscles

18. A physical therapist asks a strength and conditioning specialist to explain why a patient recovering from rotator cuff surgery cannot actively raise their arm above 90 degrees of shoulder flexion despite having 160 degrees of passive ROM. Which concept best explains this discrepancy?

A. The difference between passive and active ROM — the patient's surgical repair has healed enough for external force to move the joint through most of its range, but the repaired muscles lack the strength to actively produce movement beyond 90 degrees

B. The patient has a permanent structural restriction that prevents all motion beyond 90 degrees

C. The goniometer used to measure passive ROM was calibrated incorrectly

D. The passive ROM measurement is always lower than active ROM after surgical repair

19. The Golgi tendon organ (GTO) is located at the musculotendinous junction and detects changes in muscle tension. When tension exceeds a threshold, the GTO produces autogenic inhibition. Which PNF stretching technique specifically exploits this mechanism to achieve a greater range of motion?

A. Ballistic stretching using rapid bouncing movements at end range to override the GTO reflex

B. The contract-relax technique, where the athlete isometrically contracts the target muscle before stretching it — the contraction activates the GTO, which then reflexively inhibits the muscle and allows a greater subsequent stretch

C. Static stretching held for 10 seconds to fatigue the GTO and permanently disable its function

D. Active isolated stretching using reciprocal inhibition exclusively with no contraction of the target muscle

20. During a maximal vertical jump, the athlete rapidly descends into a quarter squat (eccentric countermovement) then immediately reverses direction into an explosive concentric jump. The brief transition period between the eccentric and concentric phases is called the amortization phase. If this phase exceeds 250 milliseconds, what happens to the stretch-shortening cycle benefit?

A. The SSC benefit increases because the longer transition provides more time for elastic energy accumulation

B. The stretch reflex becomes more powerful because the muscle spindle has additional time to generate a stronger signal

C. The SSC benefit is unaffected because the amortization phase duration has no influence on subsequent jump performance

D. Stored elastic energy dissipates as heat and the stretch reflex contribution diminishes, reducing the total power enhancement of the SSC

21. A strength and conditioning specialist is analyzing sprint mechanics. During the maximum velocity phase (30+ meters), elite sprinters demonstrate ground contact times of approximately 80 to 100 milliseconds. Research consistently shows that the primary ground reaction force component distinguishing faster sprinters from slower ones at maximum velocity is which of the following?

A. The anteroposterior (horizontal) component that pushes the sprinter backward against the ground

B. The mediolateral component that provides side-to-side stability during single-leg support

C. The vertical component — faster sprinters apply greater vertical force relative to body weight during the brief ground contact phase

D. All three components contribute equally with no single component more important than others

22. Newton's Second Law (F = ma) predicts that the acceleration of an object depends on the net force applied and the object's mass. A 100 kg athlete performing a vertical jump produces a peak ground reaction force of 2,500 N. Given that gravitational force is approximately 981 N (100 kg × 9.81 m/s²), what is the net upward force and resulting upward acceleration?

A. Net force = 1,519 N upward; acceleration = approximately 15.2 m/s² upward — calculated by subtracting gravitational force from GRF and dividing by mass

B. Net force = 2,500 N because gravitational force does not need to be subtracted from the GRF

C. Net force = 0 N because the athlete's GRF exactly equals gravity at all points during the jump

D. Acceleration cannot be determined from force and mass data alone

23. The muscle spindle and the Golgi tendon organ produce opposite reflexive responses when activated. A scenario in which both proprioceptors are simultaneously activated during a heavy isometric contraction produces a competition between their respective reflexes. At very high tension levels, which reflexive outcome typically dominates?

A. The muscle spindle always dominates regardless of tension level, producing maximal contraction

B. The GTO's inhibitory signal can override the spindle's facilitatory signal, producing autogenic inhibition that limits maximal voluntary force — a protective mechanism that chronic heavy training can reduce

C. Neither proprioceptor produces any reflex during isometric contractions because they only function during dynamic movements

D. Both reflexes cancel out completely, leaving the muscle in a state of zero tension

24. A highly trained endurance cyclist has a resting cardiac output of approximately 5.2 L/min, a resting heart rate of 44 bpm, and a resting stroke volume of approximately 118 mL/beat. During maximal exercise, this athlete's cardiac output increases to 35 L/min. The primary cardiovascular adaptation that enables this dramatic maximal cardiac output is which of the following?

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

B. Concentric cardiac hypertrophy with thickened ventricular walls providing greater pressure generation

C. Reduced maximal heart rate that is compensated by decreased stroke volume at peak effort

D. Increased maximal stroke volume from eccentric cardiac hypertrophy (enlarged left ventricular chamber) combined with increased blood volume and enhanced contractility

25. During moderate-intensity aerobic exercise, blood flow to working muscles increases dramatically while flow to non-essential organs decreases. In the working muscles specifically, local vasodilation is triggered by which combination of metabolic signals?

A. Increased blood viscosity and elevated red blood cell concentration within the active muscles

B. Decreased sympathetic nervous system activity to the active muscles at all exercise intensities

C. Increased local concentrations of CO_2, decreased O_2, elevated temperature, and accumulation of metabolic byproducts that directly relax vascular smooth muscle

D. Increased parasympathetic stimulation that opens all blood vessels throughout the body simultaneously

26. A resistance training session consisting of 5 exercises, 4 sets of 10 reps at 70% 1RM with 60-second rest periods produces which acute hormonal response pattern compared to a session of 5 sets of 2 at 93% 1RM with 5-minute rest?

A. The high-volume, short-rest protocol produces significantly greater acute growth hormone elevation due to the higher metabolic stress, while the heavy protocol produces greater neural adaptation

B. Both protocols produce identical hormonal responses regardless of volume, intensity, and rest

C. The heavy, long-rest protocol produces greater GH because heavier loads are the primary stimulus for GH

D. Neither protocol produces any hormonal response because resistance training does not affect circulating hormones

27. An athlete's blood work collected over 8 consecutive weeks shows a progressive decline in the testosterone-to-cortisol ratio alongside declining training performance, elevated resting heart rate, and disrupted sleep. These findings collectively suggest which condition?

A. Optimal peaking for competition with the athlete in their best physical condition

B. Normal hormonal fluctuation that requires no intervention or program modification

C. Excessive carbohydrate intake causing insulin resistance that mimics overtraining symptoms

D. Overtraining syndrome — chronic imbalance between training stress and recovery capacity producing maladaptive hormonal, performance, and symptom changes

28. Insulin-like growth factor-1 (IGF-1) produced locally within skeletal muscle in response to mechanical loading activates the mTOR signaling pathway. The mTOR pathway is the primary intracellular regulator of which physiological process?

A. Glycogen resynthesis following prolonged endurance exercise at moderate intensity

B. Muscle protein synthesis — the production of new contractile and structural proteins within the muscle fiber

C. Phosphocreatine resynthesis through the creatine kinase reaction in the sarcoplasm

D. Beta-oxidation of fatty acids within the mitochondrial matrix during aerobic metabolism

29. According to the SAID principle, training adaptations are specific to the type of stress applied. A strength and conditioning specialist designs a program for a javelin thrower that consists exclusively of heavy bilateral lower body exercises (squats, deadlifts) performed at slow tempos with no upper body or explosive training. Which SAID principle violation is present?

A. The program includes too many exercises and should be reduced to only one exercise

B. Heavy lower body exercises always transfer perfectly to javelin throwing regardless of specificity

C. The program fails to address the sport-specific demands of javelin throwing — unilateral power, explosive upper body movement, rotational power, and high-velocity force production

D. The SAID principle does not apply to throwing sports because throwing is exclusively a technique-driven activity

30. Wolff's Law describes the relationship between mechanical loading and bone remodeling. A sedentary 55-year-old woman is diagnosed with osteopenia (low bone mineral density). Her physician recommends exercise to slow bone loss. Based on Wolff's Law, which exercise prescription provides the greatest osteogenic stimulus?

A. Ground-based resistance training with squats, deadlifts, and weighted walking lunges, which apply compressive and impact forces directly to the axial and appendicular skeleton

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

C. Seated upper body machine exercises with very light resistance and high repetitions

D. Recumbent cycling at low intensity for 60 minutes three times per week

31. A strength and conditioning specialist observes that two athletes can squat 180 kg for a 1RM. Athlete A achieves this with a 2.5-second concentric phase, while Athlete B completes the same lift in 1.5 seconds. When tested on a vertical jump, Athlete B achieves a significantly higher jump despite identical maximal strength. Which physical quality explains Athlete B's superior jump performance?

A. Greater absolute maximal strength because the squat 1RM determines vertical jump height

B. Superior aerobic endurance that enhances the oxidative contribution to the jump

C. Greater flexibility that allows a deeper countermovement and a longer propulsive phase

D. Superior power output — Athlete B produces the same force in less time, generating greater power (work ÷ time) that translates to higher jump performance

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

A. Vertically upward to achieve maximum flight time between strides during the early acceleration

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

C. Mediolaterally to provide lateral stability during the transition from stationary to moving

D. In a random direction because body lean has no effect on force direction during sprinting

33. The force-velocity relationship during eccentric muscle actions differs fundamentally from the concentric relationship. During eccentric actions, force production does which of the following as the velocity of lengthening increases?

A. Decreases steeply, following the same inverse pattern as concentric actions

B. Remains identical to concentric force production at all velocities without any difference

C. Increases slightly with increasing velocity of lengthening up to a plateau approximately 20-60% above maximal isometric force

D. Drops to zero because muscles cannot produce force while being stretched

34. Chronic endurance training produces eccentric cardiac hypertrophy, while chronic resistance training produces concentric cardiac hypertrophy. Which functional difference between these two cardiac adaptations is most relevant to the strength and conditioning specialist?

A. Eccentric hypertrophy primarily increases stroke volume and maximal cardiac output (relevant to endurance), while concentric hypertrophy primarily increases the heart's pressure-generating capacity (relevant to heavy resistance exercise with blood pressure spikes)

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

C. Concentric hypertrophy is a pathological condition requiring immediate medical treatment

D. Eccentric hypertrophy decreases stroke volume while concentric hypertrophy increases it

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

A. Slow, controlled resistance training at 50% of 1RM with a 5-second concentric tempo

B. Prolonged low-intensity aerobic exercise at 50% of VO_2max for cardiovascular conditioning

C. Sustained isometric holds at 25% of maximal voluntary contraction for 60-second durations

D. Explosive training including Olympic lifts, plyometrics, and ballistic exercises that require rapid force production

36. During heavy resistance exercise with the Valsalva maneuver, recorded blood pressure values have exceeded 400/300 mmHg. This extreme acute blood pressure response is generally well-tolerated in healthy individuals but is contraindicated for which population?

A. Professional powerlifters with extensive training experience performing in sanctioned competitions

B. Individuals with uncontrolled hypertension or cardiovascular disease where extreme blood pressure spikes pose a risk for cardiovascular events

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

D. Military personnel performing occupational fitness assessments under qualified supervision

37. An athlete has been following a periodized resistance training program for 3 years and has reached a well-developed strength base. Their vertical jump performance has plateaued despite continued strength gains. The strength and conditioning specialist determines that the athlete has a rate of force development deficit — they can produce high peak force but cannot produce it quickly enough. Which training modification is most appropriate?

A. Continuing to increase maximal strength exclusively through heavier squat loads

B. Eliminating all strength training and performing only flexibility work

C. Adding explosive training modalities — plyometrics, Olympic lifts, and jump squats — to develop the ability to express strength rapidly during the brief ground contact time of a jump

D. Reducing training to once per month to allow accumulated fatigue to dissipate completely

38. A strength and conditioning specialist is calculating the torque demand on the shoulder during a lateral raise. An athlete holds a 5 kg dumbbell at arm's length with the arm fully extended horizontally at 90 degrees of shoulder abduction. If the distance from the shoulder joint axis to the dumbbell's center of mass is 0.65 meters, what is the torque created by the dumbbell about the shoulder joint?

A. Approximately 31.9 N·m, calculated as 5 kg × 9.81 m/s² × 0.65 m = 31.9 N·m (force × moment arm)

B. Approximately 5 N·m, calculated by using only the mass without converting to Newtons

C. Exactly 0 N·m because the dumbbell exerts no torque when held at 90 degrees of abduction

D. Approximately 100 N·m regardless of the dumbbell weight or moment arm distance

39. An exercise physiologist studies substrate utilization during a graded cycling test. At 40% of VO_2max, the respiratory exchange ratio (RER) is 0.78. At 60% of VO_2max, the RER rises to 0.86. At 85% of VO_2max, the RER reaches 1.02. The progressive increase in RER with intensity reflects which metabolic shift?

A. A progressive increase in protein oxidation that produces a higher CO_2-to-O_2 ratio at all intensities

B. A decrease in all metabolic activity as exercise intensity increases beyond 50% of VO_2max

C. A constant metabolic rate with no change in fuel utilization regardless of exercise intensity

D. A progressive shift from predominantly fat oxidation (RER closer to 0.70) to predominantly carbohydrate oxidation (RER closer to 1.00) as exercise intensity increases

40. A strength and conditioning specialist is explaining the Cori cycle to an athlete. In this metabolic pathway, lactate produced by working muscles during intense exercise is transported through the blood to the liver, where it is converted to glucose through gluconeogenesis. This recycled glucose is then released back into the blood for use by which tissues?

A. Exclusively by adipose tissue for storage as triglycerides during exercise

B. By the working muscles and the brain as an energy substrate, helping to maintain blood glucose levels during sustained exercise

C. Only by the bone marrow for red blood cell production during the exercise session

D. Exclusively by the kidneys for filtration and excretion as metabolic waste

41. An athlete is performing a set of 12 repetitions of biceps curls to muscular failure. During the final 3 repetitions, the athlete reports intense burning in the biceps and struggles to complete each repetition. The burning sensation is primarily caused by which metabolic event?

A. Complete depletion of all intramuscular phosphocreatine after only 9 repetitions of curls

B. Excessive oxygen delivery causing oxidative damage to the biceps muscle fibers

C. Hydrogen ion accumulation from glycolysis reducing intracellular pH, impairing cross-bridge cycling and enzymatic function

D. Protein degradation from cortisol release that has dissolved the contractile proteins during the set

42. An exercise physiologist measures a recreational runner's lactate threshold at 55% of VO_2max. After 16 weeks of structured aerobic training, the same test reveals the lactate threshold has shifted to 70% of VO_2max. This improvement is primarily attributed to which physiological adaptations?

A. Increased mitochondrial density, enhanced oxidative enzyme activity, greater capillary networks, and improved fat oxidation capacity — all reducing the muscle's reliance on glycolysis at any given workload

B. Decreased muscle mass that reduces total metabolic demand during the running test

C. Conversion of all Type I fibers to Type IIx fibers that produce less lactate during exercise

D. Elimination of the liver's ability to produce glucose through gluconeogenesis

43. A strength and conditioning specialist is explaining to an athlete why the rest interval between maximal-effort sprints (6-second all-out efforts) should be 3 to 5 minutes. The primary physiological purpose of this extended rest period is which of the following?

A. Allowing complete glycogen resynthesis in the working muscles between sprints

B. Allowing the oxidative system to become the dominant energy pathway for the next sprint

C. Reducing blood lactate concentration to zero before the next maximal effort begins

D. Allowing near-complete phosphocreatine resynthesis so that maximal ATP-PC energy is available for the next sprint effort

44. Newton's Third Law (action-reaction) is directly relevant to athletic performance. During a vertical jump, the athlete pushes downward against the ground. According to this law, the ground pushes back with an equal and opposite force. The vertical component of this ground reaction force is primarily responsible for which aspect of jump performance?

A. The horizontal distance traveled during the flight phase of the jump

B. The upward acceleration that lifts the athlete off the ground and determines jump height

C. The rotational torque about the ankle joint during the takeoff phase

D. The landing impact absorption when the athlete returns to the ground after the jump

45. A muscle's length-tension relationship predicts that force output varies with sarcomere length due to changes in actin-myosin overlap. During a bench press, the sticking point (the weakest point in the range of motion) typically occurs just above the chest because of which combined biomechanical and physiological factors?

A. The triceps brachii are at their strongest position and overpower the pectoralis major at this angle

B. Blood flow is completely occluded to all pressing muscles at angles near the chest

C. The pectoralis major is in an excessively lengthened position with suboptimal cross-bridge overlap, and the moment arm of the barbell relative to the shoulder joint is near its maximum

D. The anterior deltoid is maximally shortened and cannot contribute to the pressing motion

46. A strength and conditioning specialist is evaluating the training program of a tennis player who has been performing only slow, steady-state aerobic training at 60% of maximum heart rate for 12 months. The tennis player's on-court performance has not improved — specifically, first-step quickness, explosive serve speed, and sprint recovery between points have stagnated. Which training principle best explains this outcome?

A. The SAID principle — slow aerobic training does not provide the specific stimulus needed for the explosive, intermittent demands of tennis, so the physical qualities required for tennis performance have not been developed

B. The principle of reversibility — the aerobic training has caused the athlete to lose all previously developed fitness

C. Wolff's Law — the aerobic training has weakened the athlete's bones to the point of performance limitation

D. The Valsalva maneuver — the athlete's breathing technique during aerobic training has impaired cardiovascular function

47. Testosterone levels in males are approximately 10 to 15 times higher than in females. Despite this significant hormonal difference, female athletes still make substantial strength gains from resistance training. The primary mechanism by which female athletes improve strength without proportional increases in circulating testosterone is which of the following?

A. Female athletes achieve strength gains exclusively through increased bone mineral density

B. Neural adaptations — improved motor unit recruitment, rate coding, and intermuscular coordination — account for a larger proportion of strength gains in females than in males

C. Female athletes compensate by producing 10 times more growth hormone than males

D. Strength gains in females are entirely due to increased flexibility rather than force production

48. A strength and conditioning specialist reviews an athlete's blood work after 12 weeks of heavy resistance training. The results show that resting testosterone has remained stable but resting cortisol has decreased from pre-training levels. The testosterone-to-cortisol ratio has increased favorably. This hormonal profile suggests which training status?

A. The athlete is in an advanced stage of overtraining requiring immediate cessation of all exercise

B. The athlete has developed a severe hormonal disorder requiring pharmaceutical intervention

C. The hormonal changes are irrelevant and provide no information about the athlete's adaptive status

D. The athlete is adapting well to the training program — the favorable T:C ratio indicates a positive anabolic-catabolic balance supporting ongoing recovery and adaptation

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

A. Connective tissue does not adapt to training at all and remains permanently unchanged regardless of loading

B. Rapid muscular strength gains can outpace connective tissue strengthening, creating a period of increased injury risk for tendons and ligaments

C. Connective tissue adapts faster than muscle, so the risk period occurs when tendons are too stiff relative to the muscles they support

D. Connective tissue adaptation is irrelevant to injury risk because tendons and ligaments are not affected by training loads

50. A strength and conditioning specialist is evaluating two athletes' vertical jump data from a force plate. Both athletes produce the same peak ground reaction force of 2,800 N. However, Athlete A reaches peak force in 120 milliseconds while Athlete B reaches peak force in 250 milliseconds. Which athlete will achieve the higher jump, and what physical quality explains the difference?

A. Athlete A will achieve the higher jump because their faster rate of force development produces a greater impulse during the limited ground contact time, resulting in greater takeoff velocity

B. Both athletes will achieve identical jump heights because they produce the same peak force

C. Athlete B will achieve the higher jump because slower force development allows more cross-bridges to form

D. Jump height cannot be predicted from force plate data regardless of the variables measured

51. An athlete who has been completely detrained for 6 weeks following surgery returns to training. Research on detraining and retraining indicates that which physical quality will decline most rapidly during the detraining period?

A. Maximal strength, which declines by 50% within the first 48 hours of inactivity

B. Aerobic capacity (VO_2max), which shows measurable declines within 1 to 2 weeks and significant losses by 6 weeks

C. Bone mineral density, which is lost completely within 3 days of bed rest

D. Flexibility, which is permanently eliminated after any period exceeding 72 hours without stretching

52. Chronic heavy resistance training has been shown to reduce the Golgi tendon organ's inhibitory influence on maximal voluntary contraction. This neural adaptation allows trained athletes to do which of the following compared to untrained individuals with similar muscle size?

A. Produce greater aerobic power through enhanced mitochondrial function in the heart

B. Exhibit slower reaction times due to reduced proprioceptive sensitivity from GTO desensitization

C. Generate less total force because the protective mechanism prevents all force production above baseline

D. Voluntarily recruit a greater percentage of their motor unit pool and produce force closer to the structural capacity of their musculotendinous units

SPORT PSYCHOLOGY (Questions 53–75)

53. A collegiate basketball player sets the following three goals: "Win the conference championship" (outcome), "Average 18 points per game by mid-season" (performance), and "Complete every shooting drill with full focus and proper follow-through" (process). According to goal-setting research, which statement about this hierarchical goal structure is most accurate?

A. Only the outcome goal matters because performance and process goals provide no motivational benefit

B. The outcome goal should be eliminated because it creates too much pressure and impairs performance

C. This hierarchical structure is optimal — the outcome goal provides long-term direction, the performance goal provides measurable benchmarks, and the process goal directs daily attention to controllable behaviors

D. All three goals should be replaced with a single vague goal to reduce cognitive load

54. Self-efficacy theory identifies four sources of self-efficacy. An athlete who watches a teammate of similar ability and experience successfully complete a heavy lift they have been hesitant to attempt is experiencing which source?

A. Vicarious experience — observing someone of similar capability succeed provides evidence that the task is achievable

B. Past performance accomplishment based on personal mastery of the task

C. Verbal persuasion from the coach encouraging the attempt

D. Physiological state interpretation based on reduced pre-lift anxiety

55. According to the inverted-U hypothesis, the optimal arousal level for a given task varies with task complexity. A competitive powerlifter preparing for a maximal deadlift attempt should aim for which arousal level?

A. Very low arousal to minimize muscle tension and maximize relaxation during the maximal effort

B. Relatively high arousal because gross motor, high-force tasks benefit from elevated physiological activation that supports maximal muscle recruitment and aggressive effort

C. Moderate arousal identical to the optimal level for a precision archery shot

D. No specific arousal level because arousal has no effect on maximal strength performance

56. An athlete preparing for an important competition reports two distinct categories of anxiety symptoms. The first group includes racing thoughts, worry about failure, and negative self-talk. The second group includes muscle tension, rapid heart rate, and sweaty palms. The cognitive symptoms (first group) are best addressed by which intervention?

A. Progressive muscle relaxation targeting the physical tension in the muscles

B. Biofeedback using heart rate monitors to reduce cardiovascular activation

C. Ice bath immersion to lower core temperature and reduce physical arousal

D. Thought stopping and positive self-talk replacement to redirect the negative thought patterns

57. A strength and conditioning specialist teaches an athlete to use imagery before competition. For the imagery to be most effective, the athlete should engage which sensory modalities during the mental rehearsal?

A. Only the visual modality while suppressing all other sensory information

B. Only the kinesthetic modality while eliminating all visual and emotional components

C. Visual, kinesthetic, auditory, and emotional components simultaneously for the richest possible mental rehearsal

D. Only the auditory modality while focusing exclusively on crowd noise

58. In Fitts and Posner's three-stage model of motor learning, a novice athlete learning the power snatch for the first time demonstrates highly variable performance, large frequent errors, and heavy reliance on verbal instruction and conscious thought. This athlete is in which stage of learning?

A. The cognitive stage — characterized by the learner trying to understand what the movement requires with inconsistent execution and frequent errors

B. The associative stage where errors are smaller and the athlete can self-correct most mistakes

C. The autonomous stage where the movement is fully automated and requires no conscious attention

D. The preparatory stage where no physical practice has occurred

59. The contextual interference effect is a well-documented motor learning finding. A training session that intermixes three different exercises in random order (ABCBCAACB) rather than practicing each in blocks (AAABBBCCC) would be expected to produce which learning outcome?

A. Faster initial improvement and superior long-term retention — random practice is superior in every respect

B. Slower initial improvement but significantly better long-term retention and transfer to novel contexts

C. Identical outcomes because practice structure has no measurable effect on motor learning

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

60. A strength and conditioning specialist provides technique feedback to an athlete after every single repetition during a training session. According to the guidance hypothesis, this feedback frequency will produce which long-term learning consequence?

A. Optimal long-term retention because maximum feedback produces maximum learning in all cases

B. Accelerated skill mastery that persists permanently without any negative consequences

C. No effect on learning because feedback frequency is completely irrelevant to motor skill acquisition

D. Impaired long-term learning because the athlete develops dependency on external feedback and fails to develop internal error-detection capabilities

61. Knowledge of performance (KP) provides information about the movement pattern itself, while knowledge of results (KR) provides information about the outcome. A coach tells an athlete: "Your vertical jump was 28 inches." This statement is classified as which type of feedback?

A. Knowledge of performance because it describes how the movement was executed

B. Intrinsic feedback because the athlete perceived it through their own sensory systems

C. Knowledge of results — information about the outcome (jump height) rather than the movement quality

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

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

A. Rest intervals between practice bouts allow for memory consolidation — the neurological process of stabilizing and transferring motor memories from short-term to long-term storage

B. Distributed practice eliminates all performance errors during acquisition

C. Massed practice produces no learning whatsoever under any circumstances

D. The rest intervals allow complete glycogen resynthesis that improves cognitive function

63. An experienced Olympic weightlifter can perform the snatch with consistent technique while simultaneously monitoring bar speed, adjusting timing, and making strategic decisions about attempt selection without conscious thought about body positions. According to Fitts and Posner's model, this athlete is in which learning stage?

A. The cognitive stage where the athlete relies heavily on verbal instruction for every repetition

B. The associative stage where errors are frequent and the athlete cannot perform without coaching guidance

C. The preparatory stage before any physical practice has begun

D. Negative transfer occurs when learning a new skill disrupts the performance of a previously established skill

64. A 16-year-old high school athlete has become increasingly withdrawn, lost interest in their sport, reports persistent sadness, and has been making self-deprecating comments about their abilities over the past several weeks. The strength and conditioning specialist should respond by doing which of the following?

A. Designing a more challenging training program to rebuild the athlete's confidence through physical accomplishment

B. Increasing the athlete's competitive schedule to provide more opportunities for success

C. Ignoring the concerns because mood fluctuations are a normal part of adolescent development

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

65. Relative Energy Deficiency in Sport (RED-S) describes the health and performance consequences of chronic low energy availability. In female athletes, the classic triad presentation includes which three interrelated conditions?

A. Dehydration, electrolyte imbalance, and heat stroke from prolonged exercise

B. Vitamin D deficiency, iron deficiency, and calcium deficiency exclusively

C. Low energy availability, menstrual dysfunction, and decreased bone mineral density

D. Excessive protein intake, hypertension, and cardiac hypertrophy from overfeeding

66. An athlete returning from ACL surgery demonstrates significant fear of re-injury during cutting and pivoting drills, despite full physical clearance from the medical team. The strength and conditioning specialist should respond by doing which of the following?

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

B. Gradually reintroducing sport-specific movements at progressive intensities while facilitating referral to a sport psychologist for addressing the psychological barriers to return

C. Permanently eliminating all cutting and pivoting from the athlete's program to prevent re-injury

D. Telling the athlete their psychological concerns are irrelevant and to focus exclusively on physical readiness

67. A strength and conditioning specialist suspects that a collegiate wrestler may be developing an eating disorder based on warning signs including extreme weight manipulation before weigh-ins, avoidance of team meals, and excessive exercise beyond the training plan. According to scope of practice guidelines, the specialist should do which of the following?

A. Prescribe a specific meal plan to correct the wrestler's nutritional deficiencies

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

C. Ignore the warning signs because weight manipulation is a traditional part of wrestling culture

D. Tell the athlete their concerns are unfounded because their current body weight is within normal range

68. Athletic burnout is a psychological syndrome characterized by three dimensions: emotional exhaustion, depersonalization (cynicism toward the sport), and a reduced sense of accomplishment. An athlete experiencing burnout would most likely present with which combination of symptoms?

A. Increased motivation, enthusiasm, and improved performance across all training activities

B. Normal mood fluctuations that resolve spontaneously within 24 hours without intervention

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

D. Persistent loss of motivation, feeling "trapped" in the sport, emotional withdrawal from teammates, and absence of enjoyment from training and competition

69. Self-determination theory identifies autonomy, competence, and relatedness as the three basic psychological needs that support intrinsic motivation. A training environment that gives athletes choice in exercise selection, provides progressively challenging tasks that build mastery, and fosters team cohesion is most likely to produce which motivational outcome?

A. Decreased motivation because providing choices overwhelms athletes with decision fatigue

B. Exclusively extrinsic motivation through external rewards and fear of punishment

C. Enhanced intrinsic motivation by satisfying all three basic psychological needs

D. Learned helplessness because progressive challenges create a sense of inadequacy

70. A sport psychologist recommends diaphragmatic breathing and progressive muscle relaxation for an athlete experiencing pre-competition anxiety. These physical relaxation techniques specifically target which component of anxiety?

A. Cognitive anxiety characterized by racing thoughts and worry about the outcome

B. Somatic anxiety characterized by physical symptoms including muscle tension, elevated heart rate, and rapid breathing

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

D. Social anxiety involving fear of judgment from spectators and media

71. In Nideffer's model of attentional focus, a soccer goalkeeper preparing to face a penalty kick shifts focus between scanning the kicker's body position (broad-external), watching the kicker's foot contact the ball (narrow-external), and feeling their own body weight shift to dive (narrow-internal). This demonstrates which characteristic of effective athletes?

A. The ability to fluidly shift between different attentional modes based on changing situational demands

B. A fixed attentional focus that never changes regardless of the sporting context

C. An inability to concentrate that impairs all aspects of competitive performance

D. A purely internal focus that prevents awareness of any external environmental information

72. Motor program theory suggests that a generalized motor program (GMP) contains invariant features (relative timing, relative force proportions, fundamental spatial pattern) that remain constant across executions, and variable parameters that can be adjusted. When a basketball player shoots a free throw from the standard distance and then shoots a three-pointer from beyond the arc, which aspect of the shooting GMP changes?

A. The relative timing and sequencing of muscle activations, which are completely restructured for each distance

B. The overall speed and absolute force of the movement, which are adjusted to project the ball the required distance while the invariant features remain constant

C. The fundamental spatial pattern of the shooting motion, which is completely different for each distance

D. Nothing changes because the GMP is completely fixed and cannot be adjusted for different conditions

73. A strength and conditioning specialist observes that an athlete performs well in practice but consistently underperforms during high-pressure competitions. The athlete reports intense worry, fear of failure, and negative self-talk during competition. This pattern is most consistent with which psychological phenomenon?

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

B. Social facilitation where the presence of spectators always enhances performance

C. Optimal arousal producing the best possible competitive performance

D. A permanent personality disorder that prevents all competitive success

74. Research on the psychological impact of athletic injury consistently demonstrates which finding regarding the relationship between psychological factors and rehabilitation outcomes?

A. Psychological factors have no effect on rehabilitation timelines or return-to-play outcomes

B. Athletes who experience significant psychological distress during rehabilitation (fear, frustration, depression) have longer recovery times and higher re-injury rates

C. All athletes respond identically to injury with no variation in psychological response

D. Injury always improves mental toughness and psychological resilience without exception

75. An athlete who has successfully completed a challenging 170 kg back squat for the first time reports feeling significantly more confident about attempting 175 kg next week. According to Bandura's self-efficacy theory, this increased confidence is primarily driven by which source?

A. Past performance accomplishment — the direct mastery experience of successfully completing the 170 kg squat

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

C. Verbal persuasion from the coach encouraging the athlete to attempt more weight

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

NUTRITION (Questions 76–95)

76. A 100 kg strength athlete requires daily protein intake at the upper end of evidence-based recommendations to support heavy resistance training adaptation. At 2.2 g/kg/day, what is the total daily protein target?

A. 80 grams per day based on the general population RDA of 0.8 g/kg

B. 150 grams per day based on a moderate recommendation of 1.5 g/kg

C. 300 grams per day based on an exaggerated recommendation of 3.0 g/kg

D. 220 grams per day calculated as 100 kg × 2.2 g/kg/day

77. An athlete consumes a post-exercise meal containing 30 grams of whey protein and 90 grams of high-glycemic carbohydrate within 30 minutes of completing a high-intensity training session. The physiological rationale for this specific nutrient combination and timing is which of the following?

A. The whey protein suppresses all cortisol production for 48 hours while the carbohydrate eliminates future muscle soreness

B. This meal is excessively caloric and will be stored exclusively as body fat regardless of training status

C. The whey protein stimulates muscle protein synthesis through leucine-triggered mTOR activation, the carbohydrate rapidly replenishes glycogen through maximal glycogen synthase activity, and the insulin response from carbohydrate enhances amino acid uptake into muscle

D. Post-exercise nutrition has no effect on recovery or adaptation under any circumstances

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

A. Excessive carbohydrate intake causing metabolic syndrome and insulin resistance

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

C. Excessive protein intake causing renal overload and hormonal disruption

D. Inadequate water intake causing chronic dehydration that mimics hormonal suppression

79. During a marathon on a warm day, an athlete consumes 3 liters of plain water per hour without any sodium replacement. After 3 hours, the athlete becomes confused and disoriented. The emergency medical team diagnoses exercise-associated hyponatremia. This condition was caused by which physiological mechanism?

A. Excessive blood sodium concentration from sodium retention during prolonged exercise in heat

B. Dangerous dehydration from insufficient total fluid intake during the marathon event

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

D. Rhabdomyolysis from mechanical damage to skeletal muscle during the prolonged running event

80. Creatine monohydrate supplementation increases intramuscular phosphocreatine stores. An athlete who uses the maintenance-only approach (3-5 grams per day without a loading phase) will achieve full muscle creatine saturation in approximately how long?

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

B. Full saturation can never be achieved without the loading phase

C. 6 to 12 months of supplementation regardless of the daily dose taken

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

81. Caffeine enhances exercise performance at doses of 3 to 6 mg/kg consumed 30 to 60 minutes before exercise. An 80 kg athlete should consume approximately how many milligrams of caffeine to achieve the lower end of the effective ergogenic dose range?

A. 40 mg — a half cup of regular coffee providing minimal stimulation

B. 800 mg — a dose that far exceeds the recommended range and increases side effect risk

C. 240 mg (80 kg × 3 mg/kg), which represents the lower end of the effective ergogenic dose

D. 10 mg — an amount too small to produce any measurable physiological effect

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

A. Less than 5 seconds where the phosphagen system is the exclusive energy contributor

B. 1 to 4 minutes where glycolytic hydrogen ion accumulation is the primary performance limiter

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

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

83. An athlete subject to WADA anti-doping regulations wants to minimize the risk of an inadvertent positive drug test from supplement contamination. The strength and conditioning specialist should recommend purchasing only products that carry which third-party certification?

A. NSF Certified for Sport or Informed Sport, which independently test for banned substances and verify accurate labeling

B. USDA Organic certification, which guarantees the supplement is free of all banned substances

C. FDA pharmaceutical approval, which is required for all dietary supplements sold in the United States

D. ISO 9001 manufacturing certification, which verifies the absence of all performance-enhancing compounds

84. For an athlete in a caloric deficit seeking to preserve lean mass while losing body fat, the evidence supports protein intake at which level?

A. The general population RDA of 0.8 g/kg/day, which is sufficient for all populations including athletes in caloric deficit

B. Less than 0.5 g/kg/day to reduce total caloric intake as aggressively as possible

C. The same protein intake as during eucaloric periods with no adjustment needed for the deficit

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

85. Sodium bicarbonate functions as an extracellular buffer. When consumed at the typical dose of 0.2 to 0.3 g/kg body weight 60 to 90 minutes before exercise, it enhances performance during high-intensity glycolytic efforts by which mechanism?

A. Directly increasing intramuscular phosphocreatine stores by 50% above baseline

B. Stimulating muscle protein synthesis equivalent to 40 grams of whey protein

C. Increasing the pH gradient between the muscle and blood, facilitating greater efflux of hydrogen ions from working muscles and delaying acidosis-related fatigue

D. Permanently increasing VO_2max by enhancing mitochondrial oxygen utilization

86. An endurance athlete training at high volume requires carbohydrate intake at the upper end of recommendations. For sustained high-intensity training, carbohydrate intake of 7 to 12 g/kg/day is recommended. For a 70 kg athlete at 10 g/kg/day, what is the daily carbohydrate target?

A. 70 grams per day based on a very low carbohydrate approach

B. 700 grams per day calculated as 70 kg × 10 g/kg/day

C. 350 grams per day based on a moderate recommendation of 5 g/kg/day

D. 1,400 grams per day calculated by doubling the upper recommendation

87. Vitamin D deficiency is common among athletes who train indoors or live at northern latitudes. Documented consequences of vitamin D deficiency 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 and uncontrollable muscle hypertrophy beyond any desired training adaptation

C. Enhanced athletic performance from the metabolic efficiency of vitamin D-depleted tissues

D. No consequences because vitamin D has no role in any aspect of muscle or bone function

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

A. Vitamin C inhibits all iron absorption to prevent iron overload in athletic populations

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

C. Vitamin C blocks the absorption of heme iron while enhancing non-heme iron uptake

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

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 following the first session is which of the following?

A. No carbohydrate should be consumed for 12 hours to promote fat adaptation before the second session

B. 0.1 g/kg of carbohydrate — a minimal amount to avoid any insulin response

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

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

90. A plant-based athlete asks how to ensure adequate essential amino acid intake from a diet that excludes all animal products. The strength and conditioning specialist should advise which dietary strategy?

A. Consuming a variety of complementary plant protein sources throughout the day provides all essential amino acids in adequate quantities, as different plant proteins have complementary amino acid profiles

B. Plant-based diets cannot provide adequate protein under any circumstances

C. Only soy protein can provide complete amino acids, so it must be consumed at every meal

D. Supplementation with 100 grams of BCAAs daily is required to compensate for plant protein deficiencies

91. An athlete asks whether consuming protein before sleep can support overnight muscle recovery. Current evidence suggests which recommendation?

A. Protein consumed before sleep has no effect on overnight protein synthesis under any condition

B. Consuming 30 to 40 grams of casein protein before sleep sustains overnight amino acid delivery and supports muscle protein synthesis during the overnight fasting period

C. Only carbohydrate should be consumed before sleep because protein disrupts sleep quality

D. A minimum of 150 grams of protein must be consumed within 5 minutes of falling asleep

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

A. Only at breakfast regardless of training schedule because morning is the only time high-GI foods are metabolized

B. Exclusively during caloric restriction phases to suppress appetite and reduce total food intake

C. Before sleep to promote overnight growth hormone suppression and insulin resistance

D. During and immediately after exercise when rapid glucose delivery and glycogen replenishment are the priorities

93. A strength and conditioning specialist reviews the evidence on glutamine supplementation for muscle growth in healthy, well-nourished athletes. The most accurate assessment based on current research is which of the following?

A. Glutamine is the most effective muscle-building supplement available, surpassing creatine monohydrate

B. Glutamine at doses exceeding 50 grams per day permanently elevates testosterone in all populations

C. Glutamine supplementation has limited evidence for promoting muscle growth in healthy, well-nourished athletes and is not currently classified among supplements with strong ergogenic evidence

D. Glutamine is the only supplement approved by WADA for use by competitive athletes

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

A. 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

B. Fat has no physiological function and can be completely eliminated from the diet without consequence

C. Fat is the exclusive fuel for the phosphagen system during maximal-effort sprinting

D. Fat directly stimulates fast-twitch muscle fiber growth independent of resistance training

95. An athlete competing in a team sport that involves repeated sprints and changes of direction over a 90-minute match should maintain hydration during competition to prevent body weight loss exceeding approximately 2%. The general guideline for fluid intake during exercise is which of the following?

A. No fluid intake during competition because drinking impairs athletic performance

B. Approximately 200 to 300 mL every 15 to 20 minutes, adjusted for individual sweat rate and environmental conditions

C. A minimum of 3 liters consumed in a single bolus at halftime regardless of thirst or sweat rate

D. Only caffeinated beverages because caffeine enhances both hydration and performance simultaneously

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 loading any barbell exercise, the specialist should first assess each athlete's ability to perform which movement?

A. An unloaded bodyweight squat to evaluate mobility, motor control, and basic movement competency before adding external load

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

C. A barbell overhead press at 80% of estimated 1RM to test shoulder stability

D. A weighted depth jump from a 42-inch box to assess reactive strength

97. During a barbell back squat, an athlete's knees collapse inward (valgus) during the ascent from the bottom position. This technique error indicates weakness in which muscle group and should be corrected with which coaching cue?

A. The hip flexors are too strong, and the athlete should reduce hip flexion range of motion

B. The erector spinae are too weak, and the athlete should increase spinal flexion during the squat

C. The hip abductors and external rotators (gluteus medius) are weak — cue "drive your knees outward over your toes"

D. The ankle dorsiflexors are too strong, and the athlete should limit forward knee travel

98. An athlete performing the conventional deadlift is observed with the barbell drifting 6 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 hip and back extensors because the bar is lighter at this distance

B. Improved leverage for the quadriceps because the bar moves closer to the knee joint axis

C. No consequence because bar path does not affect joint loading during the deadlift

D. Increased moment arm on the lumbar spine, dramatically increasing the flexion torque and injury risk to the lower back

99. A strength and conditioning specialist is teaching the barbell bench press to a group of athletes. The specialist emphasizes that all athletes must use a closed grip with thumbs wrapped around the bar. The safety rationale for this grip requirement is which of the following?

A. A closed grip activates the pectoralis major more effectively than an open grip

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

C. A closed grip is purely a personal preference with no safety implications

D. A closed grip increases the range of motion of the bench press by 3 to 4 inches

100. During a standing barbell overhead press, an athlete arches the lower back excessively to create a more favorable pressing angle. This compensatory pattern has which primary safety consequence?

A. The correct technique for heavy overhead pressing involves maximal lumbar hyperextension

B. Enhanced deltoid activation because the arch increases the range of shoulder abduction

C. No consequence because lumbar position is irrelevant during overhead pressing movements

D. Excessive lumbar hyperextension under load creates compressive and shear forces on the lumbar spine, increasing injury risk

101. When teaching the power clean to novice athletes, the NSCA recommends a top-down teaching progression. Which exercise should be taught first in this sequence?

A. The full squat clean from the floor at near-maximal loads to test natural ability

B. The clean pull from the floor without a catch to develop pulling strength first

C. The hang clean from above the knee at challenging loads to develop explosive pulling

D. The front squat to establish the front rack receiving position before any pulling phases

102. During the second pull of the power clean, the athlete should explosively extend the hips, knees, and ankles simultaneously (triple extension) while keeping the arms straight. An athlete who initiates the second pull by bending the elbows and "curling" the bar upward is committing which error and experiencing which consequence?

A. The arm bend is the correct technique and should be encouraged for all athletes

B. The athlete is using the preferred technique for loads above 80% of 1RM

C. Pulling with the arms reduces the contribution of the more powerful hip extensors, limiting bar velocity and the weight that can be successfully cleaned

D. The arm bend increases the speed of bar elevation by engaging additional muscle mass

103. An athlete performing depth jumps from a 70 cm box demonstrates ground contact times that have progressively increased from 180 ms on the first repetition to 370 ms by the sixth repetition, with declining rebound jump height. The strength and conditioning specialist should do which of the following?

A. Increase the box height to 100 cm to force the athlete to transition faster under greater load

B. Terminate the exercise because the athlete is fatiguing and the stretch-shortening cycle benefit is being lost — continuing would train degraded movement patterns with no power development benefit

C. Add ankle weights to increase the eccentric loading stimulus during each subsequent repetition

D. Continue to 12 repetitions because plyometric training requires accumulated fatigue for adaptation

104. A strength and conditioning specialist is programming the first plyometric session for a team of 20 collegiate athletes who have completed 10 weeks of resistance training but have no plyometric experience. Which exercise selection and volume 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. High-intensity depth jumps from 42-inch boxes at 250 foot contacts per session

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

D. Exclusively weighted jump squats at 60% of 1RM for 300 foot contacts

105. When spotting a barbell back squat with a single spotter, the spotter should position themselves directly behind the athlete and place their hands in which location?

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

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

C. Near the athlete's torso with arms extending under the armpits to assist the athlete upward without gripping the bar

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

106. The Valsalva maneuver is contraindicated for individuals with cardiovascular risk factors. For which specific population is this technique appropriate?

A. All populations regardless of cardiovascular health, age, or exercise experience

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

C. Individuals recovering from recent cardiac surgery performing rehabilitative exercises

D. Healthy, trained athletes performing heavy compound lifts (near-maximal squats, deadlifts, presses) where maximal spinal stabilization is required

107. An athlete performing a barbell bent-over row 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 technique because it allows heavier loads to be used

B. Terminating the set, reducing the load, and cueing a rigid neutral spine with the pull initiated by scapular retraction

C. Adding heavier weight to force the posterior chain muscles to engage more aggressively

D. Switching to a completely different exercise because the bent-over row cannot be performed safely

108. Anti-extension core exercises (front plank, ab wheel rollout) train the core to resist lumbar hyperextension. Anti-rotation exercises (Pallof press) train the core to resist rotational forces. For an athlete with a history of lumbar disc herniation who needs trunk stability training, which exercise category is most appropriate?

A. Anti-movement exercises (planks, Pallof press, loaded carries) that develop stability without requiring trunk flexion that could aggravate the disc condition

B. Exclusively high-repetition weighted sit-ups on a decline bench targeting the rectus abdominis

C. Only explosive rotational medicine ball throws at maximum velocity loading the lumbar spine in all planes

D. No core training whatsoever because any trunk exercise is dangerous for individuals with disc pathology

109. During the acceleration phase of a sprint (first 10-30 meters), the expected body position is a pronounced forward lean. An athlete who runs fully upright from the first step experiences which performance consequence?

A. Enhanced acceleration because the upright position maximizes stride frequency

B. No effect on sprint performance because body lean has no relationship to acceleration

C. Reduced horizontal ground reaction force production, impairing acceleration because the force vector is directed too vertically

D. Improved top-speed mechanics that compensate for any reduction in initial acceleration

110. A change-of-direction test such as the pro agility shuttle (5-10-5) technically assesses change-of-direction speed rather than true agility. True agility includes which additional component that the pro agility shuttle lacks?

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

B. A timing mechanism that measures the speed of each individual direction change

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

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

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

A. Static stretching permanently destroys muscle fibers and should never be performed by any athlete

B. Dynamic stretching increases range of motion while simultaneously activating the neuromuscular system, whereas static stretching before explosive activity acutely reduces force production and power

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

D. Dynamic stretching has no effect on range of motion and serves only as a cardiovascular warmup

112. Foam rolling used as a pre-training preparation tool provides which specific advantage over static stretching?

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

B. Foam rolling permanently restructures fascial tissue to produce lasting structural changes in one session

C. Foam rolling reduces range of motion compared to static stretching

D. Foam rolling produces identical performance decrements to prolonged static stretching holds

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

A. Heavy working sets → static stretching → general warmup → cooldown

B. Static stretching → maximal-effort lifts → dynamic stretching → assistance exercises

C. General warmup → dynamic stretching → movement preparation → specific warmup with progressive loading

D. No warmup is necessary if the athlete has trained within the previous 48 hours

114. An athlete asks whether chronic cold water immersion after every resistance training session will enhance their muscle growth. Based on current evidence, the strength and conditioning specialist should advise which of the following?

A. Chronic CWI after every session is recommended because it always accelerates hypertrophy

B. Cold water immersion has no effect on any physiological process related to recovery

C. CWI should replace sleep as the primary recovery modality for all strength athletes

D. Chronic CWI after resistance training may blunt the inflammatory signaling necessary for hypertrophy and strength adaptation — it should be used selectively during competition phases, not routinely after every session

115. The single most important recovery variable — more important than any external modality — is which of the following?

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

B. Adequate sleep of 7 to 10 hours per night combined with appropriate post-exercise nutrition

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

D. Electrical muscle stimulation applied to all major muscle groups for 90 minutes nightly

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

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

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

C. Only heavy resistance training with no cardiovascular or conditioning component

D. Exclusively static stretching sessions for 60 minutes per day

117. A soccer midfielder covers 10-13 kilometers per match with interspersed high-intensity sprints. The aerobic system's most important contribution to this athlete's sport performance is which of the following?

A. The aerobic system directly powers each maximal sprint during the match

B. The aerobic system eliminates the need for the glycolytic energy system entirely

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

D. The aerobic system has no relevance to team sport performance because soccer is exclusively anaerobic

118. Interval training for a football defensive back who performs repeated 4-6 second sprints with 25-40 seconds between plays should use which work-to-rest ratio to replicate sport-specific energy system demands?

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

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

C. 1:20 ratio targeting the oxidative system with complete recovery between efforts

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

119. A strength and conditioning specialist programs 300-yard shuttle runs with 4-minute rest periods for a basketball team. This protocol primarily targets which energy system?

A. The phosphagen system through short-duration maximal efforts lasting less than 10 seconds

B. The glycolytic system through high-intensity efforts lasting approximately 60 to 90 seconds

C. The oxidative system through sustained moderate-intensity continuous activity

D. Beta-oxidation through prolonged low-intensity fat utilization

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

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

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

A. Improved thoracic extension and reduced demand on the upper back musculature

B. Enhanced quadriceps activation from the altered torso position

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 supports the bar in the rack position

122. A reverse lunge is often 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 strengthening the articular cartilage

B. Increased forward knee translation loading the quadriceps tendon more aggressively

C. Eliminated eccentric muscle action during the entire lowering phase of the movement

D. Reduced shear force on the front knee because the deceleration demand on the front leg is lower when stepping backward

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 a forward lean to shift body weight 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 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 on the lumbar spine 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 anatomical location on the athlete?

A. Directly on the dumbbells themselves to guide them along the correct movement path

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

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

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

126. Resistance bands combined with barbells create accommodating resistance. During a banded back squat, the resistance profile differs from free weights in which specific way?

A. Bands provide constant resistance identical to free weights throughout the entire range of motion

B. Bands provide maximum resistance at the bottom and minimum resistance at the top

C. Bands eliminate all resistance below 90 degrees of knee flexion

D. Bands provide minimum resistance at the bottom (least stretched) and maximum at the top (fully stretched), challenging the athlete most in the mechanically strongest position

127. A strength and conditioning specialist observes an athlete performing medicine ball rotational throws. For this exercise to qualify as a plyometric exercise, it must be performed with which characteristic?

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

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

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

D. Maximum weight to develop absolute strength rather than explosive reactive power

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

A. Directly adjacent to cardiovascular equipment for convenient circuit training transitions

B. Against mirrors so athletes can monitor their technique during all lifting attempts

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

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

129. A strength and conditioning specialist is training a group of 30 athletes in a facility with 10 squat racks. To maximize training efficiency while maintaining safety, the athletes should be organized in which manner?

A. Groups of 3 athletes per rack, rotating between squatting, spotting, and resting to maintain continuous workflow and appropriate supervision

B. All 30 athletes performing bodyweight squats simultaneously while waiting for an available rack

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

D. Eliminating all squat exercises because the facility cannot accommodate 30 athletes safely

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

A. Increasing the total weight of the barbell to provide additional resistance

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

C. Collars are decorative only and serve no functional safety purpose

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

131. An athlete's training program includes power cleans, back squats, bench press, dumbbell lateral raises, and front planks. Arranged according to proper exercise order guidelines, which sequence is correct?

A. Front planks → dumbbell lateral raises → bench press → back squats → power cleans

B. Power cleans → back squats → bench press → dumbbell lateral raises → front planks

C. Bench press → power cleans → back squats → front planks → dumbbell lateral raises

D. Dumbbell lateral raises → front planks → power cleans → back squats → bench press

132. When spotting a barbell bench press with a single spotter, the spotter should use which grip and position?

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

B. No grip on the bar — hands placed on the athlete's elbows to provide leverage

C. An alternated grip (one pronated, one supinated) close to the center of the bar, standing behind the head of the bench

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

133. For an athlete who performs explosively on the field but struggles with heavy lifts in the weight room, which training emphasis is most appropriate to develop the specific quality they lack?

A. Heavy resistance training (85%+ 1RM) to develop maximal strength, which is the foundation upon which explosive performance is built

B. Exclusive plyometric training with no resistance training component of any kind

C. Only long-distance running to develop the aerobic base needed for explosive performance

D. Only flexibility training because range of motion is the primary determinant of strength

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

A. Incorrect technique that should be immediately corrected by fully locking the knees

B. A dangerous movement pattern that places excessive stress on the hamstrings

C. Incorrect technique because the RDL requires deep knee flexion identical to a conventional squat

D. Correct RDL technique — slight constant knee flexion, neutral spine, hip hinge, and bar close to the legs

135. 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 cardiovascular endurance because swimming requires no upper body strength

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

C. Only lower body power because kicking is the exclusive propulsive force in swimming

D. Only flexibility because range of motion is the only physical quality relevant to swimming

136. An anti-rotation exercise such as the Pallof press trains the core musculature to perform which specific function?

A. Produce maximal trunk rotation at high velocity for throwing and striking sports

B. Generate rapid lateral flexion of the trunk for frontal plane athletic movements

C. Resist rotational forces and maintain spinal stability while an external load attempts to twist the torso

D. Produce trunk flexion against heavy resistance to develop the rectus abdominis

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

A. Only ankle dorsiflexion because the snatch is primarily a lower body exercise

B. Only wrist flexion because the wide grip places minimal demand on shoulder mobility

C. No mobility prerequisites exist because the snatch can be performed safely by all athletes

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

138. A strength and conditioning specialist is designing a training program for a baseball pitcher who needs both rotational power for throwing and anti-rotation stability for deceleration and spinal protection. Which exercise combination best addresses both demands?

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 primary core demand for pitchers

C. Only isometric plank holds for maximum duration because pitchers need only endurance

D. Heavy Russian twists at maximum velocity as the exclusive core exercise

139. A strength and conditioning specialist is teaching proper push-up technique before progressing athletes to barbell bench press. Which technical standard indicates a properly performed push-up?

A. The hips sag toward the floor creating a visible swayback position throughout the movement

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

C. Partial range of motion with elbows bending only 10-15 degrees per repetition

D. Elbows flared to 90 degrees from the torso regardless of shoulder comfort or safety

140. Cable face pulls are prescribed to strengthen the posterior deltoids and external rotators of the shoulder. 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 while internally rotating the shoulders

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

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

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

PROGRAM DESIGN (Questions 141–184)

141. A needs analysis for a competitive 400-meter sprinter reveals that races last approximately 45 to 55 seconds at near-maximal intensity. Based on this duration and intensity profile, which energy system combination is most critical for performance?

A. Exclusively the oxidative system because any event lasting longer than 30 seconds is entirely aerobic

B. Exclusively the phosphagen system because the initial drive from the starting blocks determines the outcome

C. Only aerobic conditioning is needed because the 400 meters is classified as a middle-distance event

D. Both the glycolytic system (primary contributor during the 45-55 second sustained high-intensity effort) and the phosphagen system (powering the explosive start and initial acceleration)

142. A strength and conditioning specialist classifies exercises for a training program. A barbell front squat loads the spine directly and requires the trunk musculature to maintain an erect posture. This exercise is classified as which type?

A. A structural exercise because it loads the axial skeleton and requires trunk stabilization to maintain postural integrity under load

B. An isolation exercise because it targets only the quadriceps with no involvement of other muscle groups

C. A non-structural exercise because the bar rests on the anterior deltoids rather than the back

D. A power exercise because all squats are performed explosively regardless of tempo

143. In a training session containing the power snatch, back squat, incline bench press, seated cable row, dumbbell biceps curl, and side plank, the correct exercise order places which exercise first?

A. Dumbbell biceps curl because isolation exercises should always precede compound movements

B. Side plank because core stability should be developed before any loaded exercise

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

D. Back squat because it is the heaviest exercise and should always be performed before lighter movements

144. For a novice athlete with limited training experience beginning their first resistance training program, which training frequency and format is most appropriate?

A. 6 sessions per week using an advanced body-part split with heavy loads from the first session

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

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

D. Daily sessions using exclusively machine-based isolation exercises at maximum intensity

145. According to the repetition maximum continuum, training with loads greater than 85% of 1RM for 6 or fewer repetitions per set with 2 to 5 minutes of rest primarily develops which physical quality?

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

B. Muscle hypertrophy through moderate loading with metabolic stress accumulation

C. Cardiovascular fitness through elevated heart rate during resistance training

D. Maximal strength through neural adaptations including increased motor unit recruitment and rate coding

146. An athlete's tested 1RM on the back squat is 160 kg. A hypertrophy-focused protocol prescribes 4 sets of 10 at 72% of 1RM with 75-second rest. What is the prescribed training load?

A. Approximately 115 kg per working set (160 × 0.72 = 115.2, rounded to 115 kg)

B. 160 kg per working set because all training should be performed at 100% of 1RM

C. 80 kg per working set calculated as 50% of the 1RM

D. 200 kg per working set calculated by adding 40 kg to the 1RM

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

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

B. Explosive power requiring full recovery for ballistic movement quality on every set

C. Muscle hypertrophy, where maintaining elevated metabolic stress and the associated hormonal environment supports the growth stimulus

D. Aerobic endurance requiring sustained elevated heart rate during resistance training

148. Daily undulating periodization (DUP) differs from linear periodization in which fundamental way?

A. DUP never uses loads above 50% of 1RM throughout the entire training program

B. DUP varies intensity and volume on a daily or weekly basis rather than across multi-week sequential phases

C. DUP eliminates all deload weeks and recovery periods from the training plan

D. DUP uses exclusively machine-based exercises and never includes free weight movements

149. Block periodization concentrates training emphasis on a small number of targeted qualities within each block. The typical three-block sequence for an advanced athlete preparing for competition is which of the following?

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

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

C. Muscular endurance → Flexibility → Cardiovascular conditioning exclusively

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

150. During the competitive in-season period, a strength and conditioning specialist reduces training frequency and volume while maintaining intensity at preparatory-period levels. What outcome is expected from this approach?

A. Dramatic strength loss because volume and frequency reductions always cause detraining

B. Significant additional strength gains from the reduced training load and increased recovery

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

D. Complete detraining within the first 48 hours despite maintained intensity

151. A strength and conditioning specialist programs a 12-week linear periodization model for a novice athlete. The expected progression through sequential phases is which of the following?

A. Hypertrophy/endurance (high volume, moderate intensity) → Strength (moderate volume, high intensity) → Power/peaking (low volume, very high intensity)

B. Power/peaking → Strength → Hypertrophy/endurance in reverse order

C. All 12 weeks at identical volume, intensity, and exercise selection with no variation

D. Random daily selection of intensity and volume with no planned progression

152. An athlete's training log shows: Week 1 = 42,000 kg volume load, Week 2 = 46,000 kg, Week 3 = 50,000 kg, Week 4 = 32,000 kg. Week 4 represents which training strategy?

A. A training error that accidentally reduced volume below the planned target

B. A deload or unloading week designed to manage accumulated fatigue before the next loading cycle

C. A peaking week where the athlete attempts new personal records at maximal intensity

D. Complete cessation of all training for the entire week with zero physical activity

153. For developing explosive power in the jump squat, peak power output typically occurs at which loading range?

A. 85 to 95% of back squat 1RM using near-maximal loads moved at very slow velocity

B. 50 to 70% of back squat 1RM providing balanced force and velocity contributions

C. Equal peak power at all loads because loading does not affect jump squat power output

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

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

C. 70 to 80% of 1RM because the hang clean is a ballistic exercise where the load is accelerated throughout the full range, requiring sufficient mass for peak power expression

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

155. Plyometric training volume for beginner athletes is recommended at which level?

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

B. 250 foot contacts consisting exclusively of high-intensity depth jumps

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

D. 10 foot contacts regardless of exercise type or the athlete's training level

156. Plyometric sessions should be performed at which point within a training day relative to other training components?

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

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

C. Only during complete rest days with no other physical activity within 72 hours

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

157. An athlete whose back squat 1RM is at the 85th percentile for their sport but whose vertical jump is at the 35th percentile demonstrates which specific training deficiency?

A. Insufficient maximal strength requiring even heavier squat loading

B. No deficiency because maximal strength always determines jump height

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

D. A rate of force development deficit — adequate maximal strength but poor ability to express it rapidly, requiring increased explosive training

158. A comprehensive conditioning program for a soccer team whose matches last 90 minutes with mixed aerobic and anaerobic demands should include which combination?

A. Exclusively heavy resistance training with no conditioning component

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

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

D. Only static stretching for 60 minutes per session

159. The transition (off-season) period following the competitive season 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 maximum-intensity training to immediately prepare for the next season

C. 6 months of complete bed rest with no physical activity of any kind

D. The transition period should be eliminated entirely in favor of continuous year-round maximal training

160. A return-to-play protocol following a unilateral lower extremity injury should include which objective criterion before unrestricted competition?

A. Subjective report of feeling "ready" with no objective testing required

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

C. The ability to walk without assistance for 5 minutes on level ground as the sole criterion

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

161. A needs analysis for a competitive ice hockey forward reveals that shifts last 45 to 60 seconds of high-intensity skating with 2 to 3 minutes of bench rest. The conditioning program should primarily 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 training is needed because skating technique alone determines performance

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

162. For an advanced athlete with 6 years of consistent training experience preparing for a single major competition, which periodization model is most appropriate?

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

B. A beginner program with 2 sessions per week at 60% 1RM with no planned progression

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

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

163. An athlete who has been training with the same program for 20 weeks reports strength gains have plateaued. According to the principle of accommodation, the most appropriate intervention is which of the following?

A. Continuing the identical program indefinitely because all plateaus resolve without any modification

B. Complete cessation of all training for 6 months to allow accumulated fatigue to fully dissipate

C. Permanently reducing all loads to 50% of 1RM to give the musculoskeletal system extended rest

D. Introducing variation in training variables (exercises, loads, volumes, periodization model) to provide novel stimuli

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

A. Progressive loading from low-intensity exercises through sport-specific movements, meeting objective bilateral symmetry criteria before unrestricted return to competition

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

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

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

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

A. Realization → Transmutation → Accumulation in reverse order

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

C. Flexibility → Cardiovascular conditioning → Muscular endurance exclusively

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

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

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

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

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

D. No structured rest — all exercises performed continuously for 90 minutes

167. A strength and conditioning specialist designs a training protocol of 5 sets of 2 at 92% 1RM with 5-minute rest periods. This protocol primarily develops which physical quality?

A. Muscular endurance through high-repetition sustained work

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

C. Muscle hypertrophy through moderate loading with metabolic stress accumulation

D. Cardiovascular fitness through elevated heart rate during the training session

168. An athlete performing the back squat has a tested 1RM of 200 kg. Their program prescribes 5 working sets of 3 at 87% 1RM with 4-minute rest. What is the prescribed working load?

A. 174 kg per working set (200 × 0.87 = 174 kg)

B. 200 kg per working set using 100% of 1RM for all training

C. 100 kg per working set calculated as 50% of 1RM

D. 250 kg per working set calculated by adding 50 kg to the 1RM

169. 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

170. During the general preparation phase of the annual training plan, the training emphasis should be on which foundational qualities?

A. Sport-specific power and speed for immediate competitive readiness

B. Complete physical rest with no training stimulus of any kind

C. A broad base of hypertrophy, general strength, work capacity, and aerobic fitness

D. Exclusively sport skill practice with no physical training component

171. During the specific preparation phase, training emphasis shifts 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 all other qualities are maintained automatically

172. A strength and conditioning specialist calculates volume load for a training session: 4 sets × 8 repetitions × 100 kg on the back squat. The total volume load is which of the following?

A. 400 kg calculated as sets multiplied by the load

B. 3,200 kg calculated as 4 × 8 × 100 — the standard formula for volume load

C. 32 repetitions calculated as sets multiplied by repetitions

D. 800 kg calculated as repetitions multiplied by load without the sets component

173. A needs analysis for a competitive rock climber identifies grip endurance, upper body pulling strength, core stability, and body composition optimization as priority physical qualities. Which exercise combination best addresses these needs?

A. Exclusively bench press and overhead press because pushing strength determines climbing ability

B. Only cardiovascular training on a stationary bicycle for 60 minutes per session

C. Exclusively lower body exercises because leg strength is the primary determinant of climbing success

D. Pull-up and rowing variations for pulling strength, dead hangs and farmer's carries for grip endurance, anti-extension/anti-rotation core exercises for trunk stability, and nutritional guidance for body composition

174. An in-season strength maintenance program prescribes 2 sessions per week with reduced volume but maintained intensity. If the sport coach eliminates one session to add an extra practice, the consequence is which of the following?

A. No consequence because one session per week is always sufficient for complete maintenance

B. The team will gain significant additional strength from the extra practice session

C. Reducing to one session per week increases the risk of strength detraining if the remaining session cannot maintain adequate intensity and total stimulus

D. The extra practice provides an identical neuromuscular stimulus to the eliminated strength session

175. A novice athlete beginning their first resistance training program should use which loading and repetition strategy during the first 4 to 6 weeks?

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% of estimated 1RM with single repetitions from the first session

C. Only plyometric depth jumps from maximum-height boxes with no foundational strength work

D. No resistance training for 12 months while focusing exclusively on cardiovascular exercise

176. Plyometric training frequency should be limited to 2-3 sessions per week with at least 48-72 hours between sessions. The primary rationale is which of the following?

A. The recovery time is purely arbitrary with no physiological basis

B. The 48-72 hour interval is needed only for cognitive processing of movement patterns

C. The recovery period is needed exclusively for cardiovascular system restoration

D. Adequate recovery of musculotendinous structures that experience significant eccentric loading during plyometric exercises

177. A strength and conditioning specialist programs conditioning for American football offensive linemen who perform 4-7 second plays with 25-40 seconds between plays. The most sport-specific conditioning protocol is which of the following?

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

B. Sprint intervals of 5-10 yards with 25-40 second rest replicating the position's phosphagen-dominant demands

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

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

178. An athlete's annual training plan should organize the training year in which sequence from start to finish?

A. Competition → Transition → General preparation → Specific preparation

B. Transition → Competition → General preparation → Specific preparation

C. General preparation → Specific preparation → Competition → Transition

D. Specific preparation → General preparation → Transition → Competition

179. A strength and conditioning specialist designs a training protocol: 4 sets of 12 at 70% 1RM with 60-second rest periods. This protocol targets which training adaptation?

A. Muscle hypertrophy through moderate loading with mechanical tension and metabolic stress from short rest

B. Maximal strength through heavy loading with complete neural recovery

C. Explosive power through ballistic movement at high velocity

D. Phosphagen system development through brief maximal-intensity efforts

180. A strength and conditioning specialist is working with a martial artist who competes in 3-minute rounds with 1-minute rest between rounds. The conditioning program 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. No energy system training is needed because technique alone determines competitive outcome

D. The glycolytic system because 3-minute rounds of sustained high-intensity fighting fall within the glycolytic-dominant range, supported by phosphagen for explosive efforts and aerobic for between-round recovery

181. An athlete who has been completely detrained for 8 weeks following surgery begins a reconditioning program. The initial phase should start at which intensity relative to pre-surgery training levels?

A. 100% of pre-surgery intensity and volume to rapidly restore previous fitness

B. Significantly reduced intensity and volume with gradual progressive increases based on tolerance and performance response

C. 120% of pre-surgery levels to compensate for the detraining period losses

D. The identical advanced program the athlete was following before the surgery

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% with explosive tempo (power). The primary advantage of this structure is which of the following?

A. DUP eliminates the need for any planned structure because daily variation is completely random

B. DUP never uses heavy loads, making it inherently safer than linear periodization

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

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

183. An injured athlete with a wrist injury preventing barbell gripping should have their program modified to include which lower body exercises?

A. Belt squats, leg press, goblet squats with modified grip, and other exercises that do not require a conventional barbell grip

B. Only upper body machine exercises to maintain strength in uninjured areas

C. No training of any kind until the wrist is fully healed with no modifications permitted

D. Heavy barbell back squats with standard grip because the wrist will adapt under load

184. A strength and conditioning specialist is programming for a decathlete competing in 10 events over 2 days. Which periodization approach best addresses the uniquely broad range of physical qualities (sprint speed, endurance, jumping power, throwing power, technical skills) this athlete must develop?

A. Block periodization focusing exclusively on one event for 4 weeks before moving to the next

B. Linear periodization training only sprinting for 6 months then only throwing for 6 months

C. No structured training because the variety of events makes periodization impossible

D. Concurrent training with undulating periodization addressing multiple physical qualities simultaneously throughout the training year

TESTING AND EVALUATION (Questions 185–206)

185. A strength and conditioning specialist needs to assess lower body explosive power in 40 high school athletes during a single 90-minute testing session. Which test is the most practical and valid field assessment?

A. Laboratory-based isokinetic dynamometry requiring 30 minutes per athlete individually

B. Force plate analysis with synchronized 3D motion capture requiring specialized technicians

C. The vertical jump (countermovement jump) using a Vertec device — valid, reliable, practical for large groups, and can be administered efficiently

D. Underwater weighing to assess body composition as a proxy for lower body power

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

A. Face validity based on the test's apparent relevance to the sport being assessed

B. Reliability — the consistency and reproducibility of scores, meaning observed changes likely reflect true performance improvement rather than measurement error

C. Construct validity because the test accurately measures an underlying physiological quality

D. Criterion validity demonstrated by comparison with a gold-standard measurement

187. During 1RM testing, an athlete successfully lifts 120 kg with proper technique and full range of motion, then fails at 125 kg when the bar stalls at the sticking point. The 1RM is recorded as which value?

A. 120 kg — the last weight successfully lifted with acceptable technique through the full range of motion

B. 125 kg because the athlete attempted this weight even though they could not complete it

C. 122.5 kg calculated as the average of the successful and failed attempts

D. The test is invalid and must be completely restarted from the beginning

188. An athlete's countermovement jump height is 60 cm and static jump height is 50 cm. The 10 cm difference reflects which neuromuscular capacity?

A. Maximum aerobic power measured during the vertical jump testing session

B. Absolute maximal strength of the quadriceps independent of contraction velocity

C. Hamstring-to-quadriceps strength ratio as a predictor of anterior cruciate ligament injury risk

D. Stretch-shortening cycle utilization — the contribution of stored elastic energy and the stretch reflex from the countermovement to concentric force production

189. A strength and conditioning specialist needs to assess aerobic capacity in 50 soccer players during an outdoor session with minimal equipment (cones, tape, sound system). Which test is most appropriate?

A. Direct VO_2max measurement on a laboratory treadmill with metabolic cart analysis

B. Wingate anaerobic power test on a cycle ergometer requiring specialized equipment

C. The 20-meter multistage shuttle run (beep test), requiring only cones and a sound system and providing a valid estimate of aerobic capacity

D. 1RM back squat test to assess maximal lower body strength as a proxy for aerobic fitness

190. Skinfold body composition assessment involves a two-step calculation. The correct sequence is which of the following?

A. Skinfold thicknesses directly produce body fat percentage without intermediate calculation

B. Skinfold thicknesses are entered into population-specific prediction equations to estimate body density, which is then converted to body fat percentage using equations such as the Siri equation

C. Skinfold thicknesses are used only to calculate bone mineral density

D. Skinfold thicknesses are multiplied by body weight to produce fat mass in kilograms

191. Bioelectrical impedance analysis (BIA) for body composition assessment is most significantly affected by which variable that can alter results by several percentage points?

A. The athlete's hydration status, which affects the body's electrical conductivity

B. The ambient temperature in the testing facility

C. The brand of athletic shoes worn during the measurement

D. The time zone in which the testing is performed

192. Sprint testing using electronic timing gates is more accurate than hand timing because electronic systems eliminate which specific measurement error?

A. Wind resistance affecting the athlete's running speed during the test

B. Temperature effects on the athlete's muscle contraction velocity

C. The color of the lane markings on the testing surface

D. The human timer's reaction time variability, which introduces approximately 0.1-0.3 seconds of error

193. A bilateral comparison reveals an athlete's single-leg vertical jump produces 42 cm on the right and 33 cm on the left — an asymmetry of approximately 21%. Based on clinical thresholds, this suggests which of the following?

A. Normal bilateral variation requiring no intervention or assessment

B. The athlete should stop all training and rest for 6 months before retesting

C. A clinically significant asymmetry exceeding the 10-15% threshold that warrants targeted corrective programming and possible medical evaluation

D. The right leg is overtrained and should be detrained to match the left

194. An athlete's test results show: back squat = 82nd percentile, vertical jump = 35th percentile, pro agility = 58th percentile, 1.5-mile run = 63rd percentile. Which quality should receive the highest programming priority?

A. Maximal strength, already well-developed at the 82nd percentile

B. Explosive power (vertical jump at 35th percentile), disproportionately low relative to the high strength level indicating a rate of force development deficit

C. Aerobic endurance at the 63rd percentile

D. Agility at the 58th percentile

195. Testing should be conducted under standardized conditions. The most critical factor for ensuring changes in scores reflect true performance improvement is which of the following?

A. Identical testing conditions across sessions — same warmup, equipment, test order, time of day, and environmental conditions

B. Using different tests at each time point to prevent the athlete from adapting to the testing protocol

C. Allowing the athlete to choose their warmup and conditions each session

D. Testing immediately after a heavy training session to evaluate fatigued performance

196. An athlete returning from ACL reconstruction completes testing with the surgical leg achieving 88% of the non-surgical leg on the single-leg hop. Based on the 90% symmetry criterion, the recommendation is which of the following?

A. The athlete has met all criteria and should return to unrestricted competition immediately

B. The athlete's training volume should be reduced because the asymmetry suggests overtraining

C. Bilateral hop testing has no relevance to ACL return-to-play decisions

D. The athlete should continue progressive strengthening because the surgical leg has not yet met the 90% symmetry threshold

197. The T-test assesses multidirectional movement ability through which specific movement pattern?

A. A straight-line sprint of 40 yards followed by an immediate stop

B. Repeated vertical jumps for 60 seconds measuring total jump count

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

D. An agility ladder drill with predetermined footwork patterns

198. Submaximal 1RM prediction equations are most accurate when the repetitions completed are within which range?

A. 25-30 repetitions providing the most data points for statistical accuracy

B. 10 or fewer repetitions, because the relationship between reps and 1RM becomes less linear at higher counts

C. 15-20 repetitions to ensure the athlete fully demonstrates their muscular endurance capacity

D. Exactly 1 repetition, which eliminates the need for any prediction equation

199. A force plate during vertical jump testing can measure which variables that simpler methods cannot?

A. Peak ground reaction force, rate of force development, impulse, and power output in addition to jump height

B. Only jump height from standing reach minus jumping reach

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

D. Only flight time from takeoff to landing

200. Performance testing should be conducted at which intervals to track progress without excessive training disruption?

A. Daily to capture maximum data on performance fluctuations

B. Only once at the beginning of the athlete's career with no subsequent testing ever

C. Randomly with no planned schedule to prevent athletes from preparing for testing

D. At the beginning and end of each major training phase and at pre/post-season time points

201. The sit-and-reach test is the most commonly used field flexibility assessment. Its primary limitation is which of the following?

A. The test requires expensive laboratory equipment unavailable in most facilities

B. The test takes more than 30 minutes to administer for a single athlete

C. It primarily measures hamstring and lower back flexibility, does not assess other joints, and is influenced by limb proportions

D. It measures only shoulder flexibility with no relevance to the lower body

202. Goniometric assessment provides which specific advantage over the sit-and-reach test for flexibility evaluation?

A. Goniometry is less accurate than the sit-and-reach for all joints in the body

B. Joint-specific range of motion measurements at any individual joint, identifying restrictions the sit-and-reach cannot detect

C. Goniometry provides identical information to the sit-and-reach with no additional value

D. Goniometry can only measure hip range of motion and has no application for other joints

203. A strength and conditioning specialist conducts pre-season and post-season testing. Test changes should be interpreted by which method to determine if improvements are meaningful?

A. Comparing the magnitude of change to the test's known measurement error to confirm changes exceed normal variability, and evaluating percentile changes against normative data

B. Ignoring all results because testing data has no practical application to programming

C. Reporting only absolute values without any context, comparison, or error analysis

D. Assuming all changes are measurement error with no real improvement possible

204. An athlete's vertical jump has not improved after 12 weeks of plyometric training. Reassessment reveals their squat 1RM is only 1.2× body weight. Which modification is most appropriate?

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

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

C. Eliminating all lower body exercises and focusing on upper body development

D. Adding heavy resistance training to develop the strength base needed for plyometrics to produce further gains — the squat below 1.5× body weight limits SSC effectiveness

205. The Cooper 12-minute run test and the 1.5-mile run test both estimate VO_2max. Which limitation applies to both?

A. They require expensive laboratory metabolic analysis equipment

B. They cannot distinguish between athletes of different fitness levels

C. Both depend on the athlete's ability to self-pace at maximal effort, which is influenced by motivation and pacing experience

D. Both can only be administered to one athlete at a time

206. When conducting 1RM testing, the standardized protocol includes how many progressive warmup sets before maximal attempts?

A. No warmup — the athlete attempts estimated 1RM immediately

B. Approximately 3-4 progressively heavier warmup sets (50%, 70%, 80-85% of estimated 1RM) before single repetitions at near-maximal loads

C. One set of 50 repetitions at very light weight to maximize blood flow

D. 10 sets of 10 repetitions at increasing loads for complete physiological readiness

ORGANIZATION AND ADMINISTRATION (Questions 207–220)

207. A university plans a new strength and conditioning facility to accommodate 60 athletes simultaneously. Using the NSCA's minimum guideline of 40 square feet per athlete, the minimum floor space is which of the following?

A. 2,400 square feet (60 × 40), with the upper guideline of 60 sq ft producing 3,600 sq ft

B. 600 square feet based on 10 square feet per athlete

C. 6,000 square feet based on 100 square feet per athlete

D. 1,200 square feet based on 20 square feet per athlete

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

A. Only once when the facility first opens with no subsequent rehearsals needed

B. Only when a new staff member is hired for orientation purposes

C. Every 10 years aligned with facility renovation cycles

D. At least annually with all staff members participating, and ideally more frequently

209. The NSCA requires CSCS-credentialed professionals to maintain current certification in which emergency response skill?

A. Advanced cardiac life support requiring physician-level training

B. Emergency medical technician certification at the paramedic level

C. CPR and AED use from a recognized provider

D. Wilderness first responder certification for remote environments

210. In negligence law, the "standard of care" represents which legal concept?

A. The maximum insurance coverage required by state law for fitness facilities

B. The degree of care, skill, and diligence a reasonably competent professional with similar training would exercise under similar circumstances

C. The minimum salary a professional must earn to demonstrate competence

D. The number of continuing education credits required for recertification

211. A signed waiver documents that the participant was informed of inherent risks and agreed to participate. A waiver generally does NOT protect against which type of claim?

A. Gross negligence or reckless conduct demonstrating willful disregard for participant safety

B. Inherent risks clearly disclosed and voluntarily assumed by the participant

C. Normal muscle soreness following an appropriately designed training session

D. Documented inherent risks of resistance training that the participant explicitly acknowledged

212. An athlete asks the specialist to diagnose chronic knee pain and prescribe rehabilitation exercises. According to scope of practice, the specialist should do which of the following?

A. Diagnose the condition and prescribe a comprehensive rehabilitation protocol

B. Prescribe anti-inflammatory medications based on the athlete's body weight

C. Perform a surgical evaluation to determine the structural damage

D. Refer to a qualified medical professional (physician, athletic trainer, physical therapist) for diagnosis and rehabilitation

213. Which activity falls within the CSCS scope of practice?

A. Diagnosing musculoskeletal injuries through physical examination

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

C. Designing periodized training programs, teaching exercise technique, administering performance tests, and managing the facility

D. Providing psychological counseling for clinical depression and anxiety disorders

214. Equipment showing damage, excessive wear, or mechanical malfunction should be handled by which protocol?

A. Continued use until it breaks completely because replacement is expensive

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

C. Hidden from athletes to prevent unnecessary anxiety about equipment safety

D. Only the manufacturer can evaluate damage, so nothing should be done until they visit

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

A. Decline to implement unsafe practices, explain the evidence-based rationale, and advocate for athlete safety

B. Always comply because the coach has ultimate authority over all decisions

C. Resign immediately without discussion

D. Implement the demands but document objections in a private personal journal

216. Supervision ratios should be adjusted based on which factors?

A. Only the total number of athletes regardless of exercises being performed

B. Only the time of day the training session occurs

C. Only the physical dimensions of the facility

D. The complexity of exercises, the experience level of athletes, and the qualifications of supervisory staff

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

A. Only the facility's financial statements and tax returns

B. Only social media posts documenting training sessions

C. Athlete training logs, testing data, signed waivers, medical clearance forms, equipment maintenance records, and incident reports

D. Only the head coach's practice plans

218. A colleague without appropriate credentials has been independently teaching heavy Olympic lifts to inexperienced athletes. The appropriate response is which of the following?

A. Ignoring the situation because it doesn't involve the specialist's athletes

B. Addressing the concern with the colleague and/or supervisor, as unqualified instruction of technically demanding exercises creates significant safety and liability risk

C. Encouraging the colleague to increase loads to accelerate the athletes' development

D. Posting about the situation on social media to alert the public

219. A strength and conditioning facility has an established policy requiring closed-toe athletic shoes. An athlete arrives wearing sandals. The specialist should do which of the following?

A. Enforcing the policy — not allowing the athlete to train until they return with proper footwear, as open-toed shoes create unacceptable risk from dropped weights

B. Allowing the athlete to train because enforcing footwear rules is unnecessarily strict

C. Allowing barefoot training as an alternative to sandals

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

220. The NSCA's 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

B. Ultimate professional authority and responsibility for the design and implementation of the strength and conditioning program

C. Authority limited to equipment purchasing and facility maintenance only

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

PRACTICE EXAM 5 — ANSWER KEY WITH EXPLANATIONS

SECTION 1 — SCIENTIFIC FOUNDATIONS

EXERCISE SCIENCE (Questions 1–52)

1. C — Athlete X's 65% Type I fiber composition supports sustained, fatigue-resistant aerobic activity ideal for distance running. Athlete Y's 70% Type II composition supports explosive, high-force, short-duration efforts ideal for sprinting. Fiber type distribution is largely genetic and strongly influences which activities an individual is physiologically suited for.

2. D — During the 3-second static hold at lockout, the hip extensors and erector spinae generate force without changing length — the definition of an isometric muscle action. No joint angle change occurs during the hold, distinguishing it from concentric (shortening) or eccentric (lengthening) actions.

3. B — Chronic resistance training promotes the well-documented transition of Type IIx fibers to the more fatigue-resistant Type IIa phenotype. Sedentary individuals actually have higher proportions of Type IIx fibers than trained athletes because training converts these fibers to the intermediate Type IIa subtype that retains fast-twitch characteristics while gaining oxidative capacity.

4. A — When calcium binds to troponin C, the troponin complex undergoes a conformational change that shifts tropomyosin away from the myosin binding sites on actin. This exposure of the binding sites allows the energized myosin heads to attach to actin and begin the cross-bridge cycle that produces contractile force.

5. D — According to the force-velocity relationship, higher loads at slower velocities allow more cross-bridges to form simultaneously and cycle through the power stroke, producing greater maximal force. Exercise A (90% 1RM at slow velocity) places the muscle at the high-force end of the curve, while Exercise B (30% 1RM at high velocity) emphasizes the high-speed end.

6. B — The novice's rapid 40% strength gain with no structural change is driven by neural adaptations — improved motor unit recruitment, rate coding, and intermuscular coordination. The trained lifter's slower 3% gain with measurable hypertrophy reflects that their neural capacity is already near maximum, so further progress requires the slower process of structural muscle growth.

7. A — The two mechanisms by which the nervous system grades force are motor unit recruitment (activating progressively more and larger motor units as force demands increase) and rate coding

(increasing the firing frequency of active motor units to increase force per unit). Individual fibers cannot produce partial contractions due to the all-or-none principle.

8. C — The ventilatory threshold corresponds to the lactate threshold — the intensity where lactate accumulation exceeds clearance. The disproportionate ventilation increase occurs because the bicarbonate buffering system converts hydrogen ions and bicarbonate into water and CO_2, and this additional CO_2 must be expelled through increased breathing to maintain blood pH.

9. D — With only 20 seconds of rest between 10-second maximal sprints, phosphocreatine can only partially replenish (approximately 50% recovery occurs in 30 seconds, and full recovery requires 3-5 minutes). Each successive sprint begins with progressively less available PCr, reducing the phosphagen system's contribution and forcing greater reliance on glycolysis with its fatigue-inducing byproducts.

10. B — Two-minute periods of sustained high-intensity grappling fall squarely within the glycolytic-dominant duration range (15 seconds to approximately 2-3 minutes). The glycolytic system provides the primary ATP contribution during each period, while the phosphagen system powers explosive individual techniques and the aerobic system supports recovery between periods.

11. A — Fat oxidation through beta-oxidation produces ATP at a much slower rate than carbohydrate metabolism despite yielding far more ATP per molecule (approximately 129 vs. 36-38). During high-intensity exercise, the ATP demand exceeds what fat oxidation can supply, forcing the body to rely on the faster carbohydrate pathways to meet the rapid energy requirement.

12. C — The steep rise in blood lactate from 2.0 mmol/L at 70% to 4.0 mmol/L at 75% represents the lactate threshold — the intensity at which lactate production in working muscles begins to exceed the body's clearance capacity. Below this threshold, lactate production and clearance are balanced; above it, lactate accumulates exponentially.

13. D — The Krebs cycle occurs in the mitochondrial matrix and produces NADH and $FADH_2$ (electron carriers that deliver electrons to the electron transport chain), a small amount of ATP or GTP directly, and CO_2 as a byproduct. The NADH and $FADH_2$ are the primary outputs that fuel the electron transport chain for the majority of aerobic ATP production.

14. B — Protein's contribution to energy production increases substantially during glycogen-depleted states and prolonged exercise exceeding 90 minutes. When carbohydrate availability becomes limited, amino acid oxidation through deamination increases to provide carbon skeletons that enter the Krebs cycle or gluconeogenic pathways to supplement declining glucose availability.

15. A — The phosphagen system produces ATP at the fastest rate of any energy system because the creatine kinase and myokinase reactions are simple, single-step enzymatic processes that occur directly in the sarcoplasm without requiring oxygen, complex metabolic pathways, or mitochondrial processing. This speed makes it dominant for the first 6-10 seconds of maximal effort.

16. D — The biceps inserts on the radial tuberosity close to the elbow joint (short effort arm), while the dumbbell is held far from the joint (long resistance arm). This third-class lever arrangement creates a mechanical disadvantage for force — the muscle must produce approximately 7 times the external load because the resistance arm is approximately 7 times longer than the effort arm.

17. C — The sticking point at 30 degrees above parallel occurs where the moment arm of the barbell relative to the hip joint is maximal. At this angle, the hip extensors must produce the greatest torque to continue the movement. Box squats train the athlete to produce force from a dead-stop position at this specific, mechanically disadvantaged joint angle.

18. A — The 70-degree difference between passive ROM (160°) and active ROM (90°) reflects that the surgical repair has healed enough for external force to move the joint through most of its range, but the repaired muscles lack the strength to actively produce movement beyond 90 degrees. This is a normal post-surgical finding indicating the need for progressive strengthening.

19. B — The contract-relax PNF technique involves an isometric contraction of the target muscle that generates high tension, activating the GTO at the musculotendinous junction. The GTO sends inhibitory signals through an inhibitory interneuron that reduces alpha motor neuron activity to the target muscle, temporarily decreasing its tone and allowing a greater stretch immediately afterward.

20. D — When the amortization phase exceeds approximately 250 milliseconds, 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 eccentric-to-concentric transition that maximally stimulates the spindle's facilitatory response has been disrupted.

21. C — Research on elite sprinters consistently shows that the vertical ground reaction force applied during the brief ground contact phase (80-100 ms) at maximum velocity is the primary factor distinguishing faster from slower runners. Faster sprinters produce greater vertical force relative to body weight, effectively "bouncing" off the ground with greater stiffness and force.

22. A — Net upward force = GRF minus gravitational force = 2,500 - 981 = 1,519 N upward. Acceleration = net force ÷ mass = 1,519 ÷ 100 = 15.19 m/s² upward. Only the net force above body weight produces upward acceleration — the first 981 N simply supports the athlete's weight against gravity.

23. B — At very high tension levels during isometric contractions, the GTO's inhibitory signal can override the muscle spindle's facilitatory signal, producing autogenic inhibition that limits maximal voluntary force production. This is a protective mechanism preventing tendon and bone damage. Chronic heavy training can reduce this inhibition, allowing greater voluntary force expression.

24. D — The dramatic increase in maximal cardiac output (from 5.2 to 35 L/min) is primarily enabled by increased maximal stroke volume from eccentric cardiac hypertrophy (enlarged left ventricular

chamber allowing greater filling), increased blood volume (enhancing venous return), and enhanced contractility. These adaptations collectively allow the trained heart to pump far more blood per beat and per minute.

25. C — Local vasodilation in working muscles is triggered by metabolic signals produced directly by the active muscle tissue: increased CO_2 concentration, decreased O_2, elevated temperature from metabolic heat production, and accumulation of metabolic byproducts (lactate, adenosine, potassium). These signals directly relax vascular smooth muscle, increasing local blood flow.

26. A — The high-volume, short-rest protocol maximizes metabolic stress (elevated lactate, H^+, reduced pH), which is the primary stimulus for acute growth hormone release. The heavy, long-rest protocol minimizes metabolic stress but provides greater neural stimulus through maximal motor unit recruitment. Each protocol drives different primary adaptations.

27. D — A progressive decline in the T:C ratio over 8 weeks, combined with declining performance, elevated resting heart rate, and sleep disruption, represents the classic presentation of overtraining syndrome. The chronic imbalance between training stress and recovery capacity has produced systemic hormonal maladaptation that impairs performance and health.

28. B — The mTOR (mammalian target of rapamycin) pathway is the primary intracellular regulator of muscle protein synthesis. It integrates signals from mechanical loading (via IGF-1/MGF), amino acid availability (particularly leucine), and hormonal stimulation (insulin, IGF-1) to determine the rate at which new contractile and structural proteins are produced within the muscle fiber.

29. C — The program fails to address javelin-specific demands: unilateral power (the throw is performed from a single-leg base), explosive upper body movement (the javelin is projected at high velocity through shoulder and elbow extension), rotational power (trunk rotation drives the throw), and high-velocity force production (the entire throwing motion lasts less than 1 second).

30. A — According to Wolff's Law, bone remodels in response to mechanical stress. Ground-based resistance exercises with squats, deadlifts, and weighted lunges apply large compressive and impact forces directly to the weight-bearing bones of the axial and appendicular skeleton, providing the greatest osteogenic stimulus for increasing bone mineral density.

31. D — Both athletes produce the same maximal force (180 kg 1RM), but Athlete B completes the same work in less time (1.5s vs. 2.5s). Since power equals work divided by time, Athlete B generates higher power output. This superior power translates to a higher vertical jump because jump height depends on the impulse generated during the limited ground contact time.

32. B — 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 force. This horizontal force component is essential for overcoming the body's inertia and generating forward momentum from a stationary start.

33. C — During eccentric actions, force production increases slightly with increasing velocity of lengthening, up to a plateau approximately 20-60% above maximal isometric force. This is the opposite of the concentric relationship (where force decreases with velocity) and explains why muscles can produce very high forces during rapid deceleration and landing movements.

34. A — Eccentric cardiac hypertrophy (endurance training) primarily increases left ventricular chamber size, enhancing stroke volume and maximal cardiac output — critical for sustained endurance performance. Concentric hypertrophy (resistance training) primarily thickens the ventricular wall, increasing pressure-generating capacity — critical for tolerating the acute blood pressure spikes during heavy lifting.

35. D — Rate of force development requires training at high velocities with explosive intent. Olympic lifts, plyometrics, and ballistic exercises demand rapid force production within milliseconds, directly training the neuromuscular system's ability to activate motor units quickly and reach peak force in minimal time. Slow training at any load cannot develop this quality.

36. B — Individuals with uncontrolled hypertension or cardiovascular disease are at elevated risk for cardiovascular events when blood pressure spikes dramatically during the Valsalva maneuver. The extreme transient increases (potentially exceeding 400/300 mmHg) that are safely tolerated by healthy individuals may exceed the structural or functional limits of compromised cardiovascular systems.

37. C — The athlete has adequate maximal strength but cannot express it quickly enough — a rate of force development deficit. Adding plyometrics, Olympic lifts, and jump squats trains the neuromuscular system to produce force rapidly during the brief ground contact times of jumping and sprinting. Additional heavy squat work alone would not address this specific deficiency.

38. A — Torque = force × moment arm = (5 kg × 9.81 m/s²) × 0.65 m = 49.05 N × 0.65 m ≈ 31.9 N·m. The mass must first be converted to force (Newtons) by multiplying by gravitational acceleration, then multiplied by the perpendicular distance from the joint axis to the line of gravitational force.

39. D — The respiratory exchange ratio (RER) reflects the ratio of CO_2 produced to O_2 consumed. An RER of 0.70 indicates nearly exclusive fat oxidation, while 1.00 indicates nearly exclusive carbohydrate oxidation. The progressive increase from 0.78 to 1.02 as intensity rises demonstrates the crossover from predominantly fat to predominantly carbohydrate metabolism.

40. B — In the Cori cycle, glucose recycled from lactate in the liver is released into the blood and used by working muscles (as fuel for continued exercise) and the brain (which is obligatorily glucose-dependent). This recycling pathway helps maintain blood glucose levels during sustained exercise when hepatic glycogen stores are being depleted.

41. C — During high-repetition sets to failure, the glycolytic system produces hydrogen ions that accumulate in the muscle fiber, reducing intracellular pH. This acidosis impairs cross-bridge

cycling by interfering with calcium-troponin binding, inhibits key glycolytic enzymes, and directly causes the burning sensation and progressive inability to maintain force production.

42. A — The upward shift in lactate threshold from 55% to 70% of VO_2max reflects multiple aerobic adaptations: increased mitochondrial density (processing more pyruvate aerobically), enhanced oxidative enzyme activity, expanded capillary networks (improving oxygen delivery), and greater fat oxidation capacity — all reducing the muscle's dependence on glycolysis at any given workload.

43. D — The 3-5 minute rest interval allows near-complete phosphocreatine resynthesis following each 6-second maximal sprint. Since the phosphagen system is the dominant ATP contributor during 6-second all-out efforts, adequate PCr availability ensures maximal energy for each subsequent sprint. Shorter rest would reduce sprint quality by limiting available PCr.

44. B — According to Newton's Third Law, when the athlete pushes downward against the ground, the ground pushes back with an equal upward force. The vertical component of this ground reaction force produces the upward acceleration that lifts the athlete off the ground. Greater vertical GRF (above body weight) produces greater upward acceleration and therefore higher jump height.

45. C — The bench press sticking point near the chest occurs because the pectoralis major is in an excessively lengthened position where actin-myosin overlap is suboptimal (fewer cross-bridges can form), and the moment arm of the barbell relative to the shoulder joint is near its maximum (requiring greater torque from the pressing muscles).

46. A — The SAID principle states that adaptations are specific to the training stimulus imposed. Slow aerobic training develops oxidative capacity and slow-twitch fiber efficiency but does not provide the specific stimulus needed for explosive first-step quickness, maximal serve speed, or sprint recovery — all of which require high-velocity, high-power, and anaerobic training.

47. B — Female athletes make substantial strength gains primarily through neural adaptations — improved motor unit recruitment, rate coding, intermuscular coordination, and reduced antagonist co-contraction. These neural mechanisms account for a larger proportion of total strength gains in females compared to males because the lower testosterone environment limits the magnitude of structural hypertrophy.

48. D — Stable testosterone with decreased cortisol produces a favorable increase in the T:C ratio, indicating a positive anabolic-catabolic balance. This hormonal profile suggests the athlete is recovering adequately from training and adapting positively to the program. It contrasts with the declining T:C ratio seen in overtraining syndrome.

49. B — Rapid muscular strength gains from resistance training can outpace the slower structural strengthening of tendons and ligaments, which have lower metabolic activity and blood supply. This differential adaptation rate creates a window where the forces generated by stronger muscles may exceed the structural capacity of the connective tissues, increasing injury risk.

50. A — Athlete A reaches the same peak force (2,800 N) in nearly half the time (120 ms vs. 250 ms), demonstrating superior rate of force development. During a vertical jump with limited ground contact time, faster RFD produces a greater impulse (area under the force-time curve), resulting in higher takeoff velocity and jump height.

51. B — Aerobic capacity (VO_2max) declines most rapidly during detraining, with measurable reductions within 1-2 weeks of inactivity and significant losses by 6 weeks. Maximal strength is more resistant, typically maintaining for 2-4 weeks or longer. This detraining hierarchy should guide decisions about which qualities to prioritize maintaining during recovery periods.

52. D — Chronic heavy resistance training reduces the GTO's protective autogenic inhibition, allowing trained athletes to voluntarily recruit a greater percentage of their motor unit pool. This neural disinhibition enables force production closer to the true structural capacity of the musculotendinous unit — a significant contributor to strength gains beyond what hypertrophy alone provides.

SPORT PSYCHOLOGY (Questions 53–75)

53. C — The hierarchical structure is optimal: the outcome goal (championship) provides long-term direction and emotional fuel, the performance goal (18 ppg) provides a measurable benchmark to track progress, and the process goal (full focus and proper follow-through) directs daily attention to the controllable behaviors that drive improvement.

54. A — Observing a teammate of similar ability succeed provides vicarious experience — one of Bandura's four sources of self-efficacy. Seeing someone of comparable capability complete the task provides evidence that success is achievable, strengthening the observer's belief in their own ability to perform the same task.

55. B — According to the inverted-U hypothesis, gross motor, high-force tasks like a maximal deadlift benefit from relatively high arousal. Elevated physiological activation supports maximal muscle recruitment, aggressive force production, and the intense focused effort required for near-maximal lifting. Fine motor tasks, by contrast, require lower optimal arousal.

56. D — Racing thoughts, worry about failure, and negative self-talk are cognitive anxiety symptoms that require cognitive interventions. Thought stopping (interrupting the negative pattern with a cue word) followed by replacement with positive or instructional self-talk redirects cognitive resources from worry to task-relevant performance cues.

57. C — Effective imagery engages visual (seeing the performance), kinesthetic (feeling the muscular sensations and force), auditory (hearing environmental sounds), and emotional (experiencing the confidence and composure associated with success) components simultaneously. Multi-sensory engagement produces richer, more impactful mental rehearsal than any single modality.

58. A — The cognitive stage is characterized by highly variable performance, large frequent errors, heavy reliance on verbal instruction and demonstrations, and conscious thought about every

component of the movement. The learner is trying to understand what the movement requires — "What do I need to do?" — and lacks consistent execution.

59. B — The contextual interference effect demonstrates that random practice produces slower initial improvement (because task-switching disrupts immediate performance) but significantly better long-term retention and transfer (because the deeper cognitive processing builds more robust motor program representations). Blocked practice shows the opposite pattern.

60. D — The guidance hypothesis states that constant feedback (after every repetition) creates dependency on external correction. The athlete learns to wait for the coach's input rather than developing internal error-detection capabilities. Reducing feedback frequency forces the athlete to attend to their own sensory feedback, producing more self-sustaining long-term learning.

61. C — "Your vertical jump was 28 inches" is knowledge of results (KR) — information about the outcome of the performance. KR tells the athlete what happened (the result) but not how the movement was executed (the technique). Knowledge of performance (KP) would describe aspects of the movement pattern itself.

62. A — Memory consolidation — the neurological process of stabilizing and transferring motor memories from short-term to long-term storage — occurs during the rest intervals between distributed practice bouts. This consolidation process produces more durable motor program representations that resist forgetting and transfer better to novel contexts.

63. B — An athlete performing the snatch with consistent technique while simultaneously monitoring bar speed and making strategic decisions without conscious thought about body positions is in the autonomous stage. The skill has become automated, freeing cognitive resources for higher-order strategic processing and real-time performance adjustments.

64. D — Increasing withdrawal, persistent sadness, loss of interest, and self-deprecating comments in an adolescent are potential warning signs of depression that require professional evaluation. The strength and conditioning specialist should recognize these signs and recommend that parents seek assessment from a qualified mental health professional.

65. C — The female athlete triad (now expanded to RED-S) describes the interrelationship between low energy availability (caloric intake insufficient for energy expenditure), menstrual dysfunction (irregular or absent menstruation from hormonal disruption), and decreased bone mineral density (from impaired calcium and estrogen metabolism).

66. B — Fear of re-injury is a recognized psychological barrier to successful return from ACL surgery. Gradually reintroducing sport-specific movements at progressive intensities builds physical confidence through mastery experiences, while referral to a sport psychologist addresses the cognitive and emotional components through evidence-based psychological interventions.

67. A — Extreme weight manipulation, meal avoidance, and excessive exercise beyond the training plan are warning signs of disordered eating. The strength and conditioning specialist must refer to

a qualified healthcare professional for evaluation and treatment. Prescribing meal plans, conducting body composition testing, or ignoring the signs are all outside scope of practice.

68. D — Athletic burnout manifests as persistent loss of motivation, feeling trapped in the sport, emotional withdrawal from teammates, and absence of enjoyment. These symptoms represent the three dimensions of burnout: emotional exhaustion, depersonalization (cynicism), and reduced sense of personal accomplishment.

69. C — Providing autonomy (exercise choice), competence (progressive challenges building mastery), and relatedness (team cohesion) satisfies all three basic needs identified by self-determination theory. Meeting these needs fosters intrinsic motivation — the most sustainable form that produces greater adherence, effort, and resilience.

70. B — Diaphragmatic breathing and progressive muscle relaxation are physical relaxation techniques targeting somatic anxiety symptoms: muscle tension, elevated heart rate, and rapid breathing. These techniques activate the parasympathetic nervous system to reduce the physiological arousal that characterizes the somatic component of competitive anxiety.

71. A — The goalkeeper demonstrates the ability to fluidly shift between attentional modes based on changing demands — broad-external (scanning the kicker), narrow-external (tracking the ball), and narrow-internal (feeling body position for the dive). This flexible attentional shifting is a hallmark of skilled performance in complex, dynamic sporting environments.

72. B — When shooting from different distances, the variable parameters (overall speed and absolute force) are adjusted to project the ball the required distance, while the invariant features (relative timing, relative force proportions, fundamental spatial pattern) of the shooting GMP remain constant. This adaptability is the functional advantage of generalized motor programs.

73. A — Consistent practice excellence with competitive underperformance, combined with worry, fear of failure, and negative self-talk, indicates choking under pressure. Excessive cognitive anxiety disrupts the automatic motor execution that the athlete demonstrates in low-pressure practice settings, causing the paradox of performing worse when it matters most.

74. B — Research consistently shows that athletes experiencing significant psychological distress during rehabilitation — fear of re-injury, frustration, depression, isolation — have longer recovery timelines and higher re-injury rates. This evidence underscores the importance of addressing psychological factors as part of comprehensive injury management and return-to-play protocols.

75. A — Past performance accomplishment is the most powerful source of self-efficacy. Successfully completing the 170 kg squat provides direct personal evidence that the athlete can lift at this level. This mastery experience creates stronger efficacy beliefs than vicarious observation, verbal encouragement, or arousal interpretation.

NUTRITION (Questions 76–95)

76. D — A 100 kg athlete at 2.2 g/kg/day requires 220 grams of protein daily (100 × 2.2 = 220). This upper-end recommendation supports the elevated protein synthesis, tissue repair, and anti-catabolic demands of heavy resistance training. The general population RDA of 0.8 g/kg (80g) is insufficient for this population.

77. C — The whey protein provides rapidly absorbed amino acids (particularly leucine) that activate the mTOR pathway for muscle protein synthesis. The high-GI carbohydrate rapidly replenishes glycogen through maximal glycogen synthase activity. The insulin response from carbohydrate enhances amino acid uptake into muscle cells, creating a synergistic post-exercise recovery effect.

78. B — Chronically inadequate dietary fat (below 15-20% of calories) impairs steroid hormone production because cholesterol is the precursor for testosterone and other steroid hormones. Fat-soluble vitamins (A, D, E, K) also require dietary fat for intestinal absorption. Both consequences directly compromise health and training adaptation.

79. A — Exercise-associated hyponatremia occurs when excessive plain water intake dilutes blood sodium below safe levels (below 135 mmol/L). Consuming 3 liters per hour for 3 hours without sodium replacement dramatically reduces serum sodium concentration, causing confusion, disorientation, and potentially life-threatening neurological symptoms.

80. D — The maintenance-only approach (3-5 grams per day without loading) achieves full intramuscular creatine saturation in approximately 28 days. This is equally effective as the loading protocol for reaching the same endpoint — it simply takes longer because the daily dose adds to intramuscular stores gradually rather than rapidly.

81. C — An 80 kg athlete at 3 mg/kg requires 240 mg of caffeine (80 × 3 = 240). This represents the lower end of the effective ergogenic dose range (3-6 mg/kg). This dose is approximately equivalent to 2-3 cups of brewed coffee, consumed 30-60 minutes before exercise for optimal timing of peak caffeine blood levels.

82. B — Beta-alanine increases intramuscular carnosine, which 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 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 assurance that a supplement will not cause an inadvertent positive drug test under WADA anti-doping rules.

84. D — During caloric deficit, protein needs increase to 2.0-2.4 g/kg/day to protect lean mass from catabolism. The elevated protein intake combined with maintained resistance training provides the

maximum defense against muscle loss during energy restriction. Lower protein intakes during deficit accelerate lean mass loss.

85. C — Sodium bicarbonate increases blood pH and the pH gradient between the muscle (acidic during intense exercise) and the blood (more alkaline from the bicarbonate buffer). This increased gradient facilitates greater efflux of hydrogen ions from working muscles, delaying the intramuscular acidosis that impairs cross-bridge function and causes fatigue.

86. B — A 70 kg athlete at 10 g/kg/day requires 700 grams of carbohydrate daily (70 × 10 = 700). This upper-end recommendation supports the extreme glycogen demands of high-volume endurance training, where daily depletion and replenishment cycles are substantial.

87. A — Documented consequences of vitamin D deficiency include impaired muscle function (reduced strength and power), compromised immune competence (increased susceptibility to illness), and elevated risk of stress fractures with decreased bone mineral density. Athletes training indoors or at northern latitudes are at greatest risk.

88. D — 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 and fortified foods. This is particularly important for athletes with low ferritin levels who rely on plant-based iron sources with lower baseline bioavailability than heme iron from animal products.

89. C — When rapid glycogen recovery is needed (two sessions within 8 hours), consuming 1.0-1.5 g/kg of carbohydrate within 30 minutes capitalizes on the period of maximal glycogen synthase activity. This enzyme is most active immediately post-exercise, and early carbohydrate intake maximizes the rate of glycogen resynthesis.

90. A — 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 adequate in methionine, while legumes have the opposite profile. Combining multiple sources across meals provides all essential amino acids in sufficient quantities.

91. B — Consuming 30-40 grams of casein protein before sleep can sustain amino acid delivery throughout the overnight fasting period (7-9 hours). Casein forms a gel in the stomach that slows digestion, providing a sustained release of amino acids that supports muscle protein synthesis during sleep when no other protein is consumed.

92. D — High-GI foods produce rapid blood glucose spikes and are most appropriately consumed during and immediately after exercise when rapid glucose delivery to working muscles and rapid glycogen replenishment are the priorities. The fast absorption rate matches the acute metabolic needs of the peri-exercise window.

93. C — Glutamine supplementation has limited evidence for promoting muscle growth in healthy, well-nourished athletes. While glutamine plays roles in immune function and gut health, it is not

classified among supplements with strong ergogenic evidence (creatine, caffeine, beta-alanine, sodium bicarbonate) for muscle hypertrophy or performance.

94. A — Dietary fat is essential for steroid hormone production (testosterone requires cholesterol as a precursor), absorption of fat-soluble vitamins (A, D, E, K require dietary fat for intestinal transport), cell membrane integrity (phospholipid bilayer structure), and provision of essential fatty acids (linoleic and alpha-linolenic acid).

95. B — General fluid intake guidelines of approximately 200-300 mL every 15-20 minutes help prevent body weight loss exceeding 2%, at which level performance impairments become measurable. Individual sweat rate and environmental conditions (temperature, humidity) should be used to personalize the fluid intake strategy.

SECTION 2 — PRACTICAL/APPLIED

EXERCISE TECHNIQUE (Questions 96–140)

96. A — Before loading any exercise, the specialist should assess each athlete's unloaded bodyweight squat to evaluate ankle dorsiflexion, hip flexion, thoracic extension, knee tracking, and spinal neutrality. This movement screening identifies mobility restrictions and motor control deficiencies that must be addressed before external load is safely added.

97. C — Knee valgus (medial collapse) during the squat indicates weakness in the hip abductors and external rotators — primarily the gluteus medius — that control femoral adduction and internal rotation under load. Cueing "drive your knees outward over your toes" provides an immediate correction while strengthening these muscles addresses the root cause.

98. D — When the bar drifts 6 inches forward during the deadlift, the horizontal distance from the bar to the lumbar spine increases dramatically. Because torque equals force multiplied by moment arm, this increased distance creates substantially greater flexion torque on the lumbar spine, dramatically elevating injury risk.

99. B — A closed grip with thumbs wrapped around the bar prevents the barbell from rolling out of the hands onto the chest, neck, or face — a potentially catastrophic event that can occur with an open (false) grip where the thumbs are on the same side as the fingers. This is a non-negotiable safety requirement.

100. D — Excessive lumbar hyperextension under load during the overhead press creates compressive and shear forces on the lumbar vertebrae, intervertebral discs, and facet joints. This compensatory pattern indicates the load exceeds the athlete's strict pressing capacity and should be corrected by reducing weight and cueing proper core bracing.

101. D — The NSCA's top-down progression begins with the front squat to establish the front rack receiving position and develop comfort with the bar on the anterior deltoids before any pulling

phases are introduced. This ensures the athlete can safely receive the bar before learning the explosive movements that deliver it.

102. C — Pulling with the arms (early arm bend) reduces the contribution of the powerful hip extensors to bar velocity. The arms should remain straight during the second pull, transmitting force from the explosive triple extension to the bar. Arm bending bypasses the most powerful muscles and limits the weight that can be successfully cleaned.

103. B — Ground contact times doubling from 180 ms to 370 ms with declining jump height indicates progressive fatigue and loss of SSC effectiveness. Plyometric training is quality-based — continuing degraded repetitions trains poor movement patterns with no power benefit. The exercise should be terminated to preserve training quality.

104. A — Novice athletes entering plyometric training should begin with low-to-moderate intensity exercises (squat jumps, CMJ, box jumps stepping down) at 80-100 foot contacts per session. High-intensity exercises and excessive volumes are inappropriate for athletes without the connective tissue conditioning and movement competency developed through progressive plyometric experience.

105. C — A single spotter for the back squat positions behind the athlete with arms extending under the armpits and hands near the torso. If the lift fails, the spotter assists by supporting the athlete upward at the torso — never by gripping the bar, which creates asymmetric loading and can cause dangerous bar shifts.

106. D — The Valsalva maneuver is appropriate specifically for healthy, trained athletes performing heavy compound lifts where maximal intra-abdominal pressure provides essential spinal stabilization. It is contraindicated for individuals with hypertension, cardiovascular disease, or during light exercises where extreme blood pressure spikes are unnecessary.

107. B — Significant spinal rounding with momentum during rows indicates excessive load and dangerous technique. The set must be terminated, the load reduced, and the athlete cued to maintain a rigid neutral spine with the pulling motion initiated by deliberate scapular retraction rather than torso jerking.

108. A — Anti-movement exercises (planks, Pallof press, loaded carries) develop trunk stability without requiring the repeated spinal flexion that can aggravate disc pathology. These exercises train the core's stabilizing function — resisting unwanted movement — while avoiding the flexion-compression loading patterns that stress intervertebral discs.

109. C — Running upright during acceleration directs ground reaction forces too vertically, reducing the horizontal force component needed to overcome inertia. The pronounced forward lean allows athletes to push more horizontally against the ground, generating the forward-directed reaction forces essential for rapid acceleration.

110. D — The pro agility shuttle uses a predetermined pattern — the athlete knows where to go before starting. True agility requires a reactive perceptual-cognitive component where the athlete must perceive, process, and respond to unpredictable stimuli while executing direction changes. This decision-making element is what the pro agility shuttle lacks.

111. B — Dynamic stretching increases range of motion while simultaneously 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. This evidence base drives the preference for dynamic stretching pre-exercise.

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

113. C — The correct warmup sequence is: general warmup (low-intensity whole-body activity) → dynamic stretching (session-specific movement patterns) → movement preparation (activation drills, low-intensity plyometrics) → specific warmup (progressive loading in the training exercises). This progression moves from general to specific.

114. D — Chronic CWI after resistance training may blunt the inflammatory signaling (prostaglandins, cytokines) necessary for muscle protein synthesis, satellite cell activation, and tissue remodeling. The acute inflammation following training is part of the adaptive cascade — chronically suppressing it may impair long-term hypertrophy and strength gains.

115. B — 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. During sleep, growth hormone peaks, protein synthesis is elevated, and neural recovery occurs. No external modality can compensate for deficits in these essentials.

116. A — Basketball's diverse demands require a comprehensive approach: aerobic base training (sustained play over 48 minutes), anaerobic interval training (repeated sprints replicating game patterns), and reactive agility conditioning (direction changes in response to unpredictable game situations). Each component addresses a specific physical demand.

117. C — The aerobic system's most important contribution to team sport athletes is recovery capacity. Between sprints and high-intensity plays, the aerobic system replenishes phosphocreatine, clears lactate and hydrogen ions, and restores metabolic homeostasis. Superior aerobic fitness enables faster recovery and sustained performance across repeated efforts.

118. D — A football defensive back performing 4-6 second sprints with 25-40 seconds between plays operates at approximately a 1:5 to 1:7 ratio, targeting the phosphagen system with near-complete PCr recovery. This matches the sport-specific energy demand pattern and ensures maximal quality on each repeated sprint effort.

119. B — 300-yard shuttles lasting approximately 60-90 seconds at high intensity target the glycolytic energy system. The work duration falls within the glycolytic-dominant range, and the 4-minute rest periods provide partial recovery consistent with glycolytic training prescriptions.

120. A — Active recovery at low intensity promotes blood flow to recovering tissues, facilitating delivery of nutrients and oxygen while assisting removal of metabolic waste products. This circulatory benefit is the primary proposed mechanism by which active recovery may improve subjective recovery compared to complete passive rest.

121. C — When elbows drop during the front squat, the bar loses its stable shelf on the anterior deltoids and rolls forward. This creates dangerous loss of control, places excessive stress on the wrists and elbows, and shifts the center of gravity forward, potentially causing the athlete to dump the bar or fall forward.

122. D — The reverse lunge reduces anterior knee shear force because stepping backward eliminates the eccentric deceleration demand on the front leg. The front leg remains relatively stationary with a more vertical shin, reducing the forces transmitted through the 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 and shifting primary loading from the knee extensors to the hip extensors. This decreases the shear forces on anterior knee structures while maintaining an effective training stimulus for the glutes and hamstrings.

124. A — The hex bar positions the load at the athlete's sides rather than in front of the body, centering it closer to the body's center of mass. This shorter distance between the load and the lumbar spine reduces the moment arm and flexion torque, decreasing spinal loading compared to the conventional barbell deadlift.

125. C — When spotting dumbbell exercises, the spotter should apply assistance at the wrists near the athlete's hands. Spotting at the elbows creates a dangerous fulcrum effect, and the dumbbells themselves may move independently. Wrist contact allows the spotter to guide the load effectively upward.

126. D — Bands provide minimum resistance at the bottom (least stretched) and maximum at the top (fully stretched). This accommodating resistance profile challenges the athlete most in the mechanically strongest position (lockout), training them to produce force through the full range where free weights alone become relatively easy.

127. B — For a medicine ball exercise to qualify as plyometric, the catch-and-throw cycle must be performed with maximal speed and minimal transition time between the eccentric catch and concentric throw. This rapid SSC execution stores and returns elastic energy and activates the stretch reflex — a slow or paused throw eliminates these mechanisms.

128. C — Olympic platforms must be separated from traffic areas with adequate clearance on all sides for dropped barbells. Athletes and staff should never walk behind or beside someone performing Olympic lifts. This safety clearance is the primary consideration for platform placement within the facility layout.

129. A — Groups of 3 per rack create efficient rotation: one squats, one spots, one rests. This maintains continuous workflow with appropriate supervision, ensures every athlete has a dedicated spotter, and keeps all 30 athletes productively engaged throughout the training session.

130. D — Collars prevent weight plates from sliding off the barbell ends during exercise. Without collars, plates can shift from uneven pressing, asymmetric racking, or momentary balance loss, causing sudden weight redistribution that may result in loss of control, dropped weights, or direct injury.

131. B — Power cleans first (power/explosive), then back squats (core multi-joint), then bench press (core multi-joint), then dumbbell lateral raises (assistance), then front planks (core stability last). This follows the established hierarchy from most neuromuscularly demanding to least demanding.

132. C — A single bench press spotter uses an alternated grip (one pronated, one supinated) close to the center of the bar, positioned behind the head of the bench. The alternated grip provides superior grip security, and the central position allows symmetric upward force application to assist the athlete.

133. A — An athlete who is explosive on the field but struggles with heavy lifts has a strength deficit — their power expression outpaces their force production capacity. Heavy resistance training (85%+ 1RM) develops maximal strength, providing the larger force foundation from which explosive movements can draw even greater power.

134. D — The description — slight constant knee flexion, neutral spine, hip hinge, bar close to legs — represents textbook RDL technique. The RDL is a hip-dominant exercise targeting the hamstrings and glutes through an eccentric hip hinge with controlled descent and concentric return to standing.

135. B — Pull-ups and lat pulldowns develop upper body 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. This combination directly addresses sport-specific performance and injury prevention needs.

136. C — The Pallof press trains the core to resist rotational forces — an external load (cable or band) attempts to twist the torso while the athlete maintains a neutral position. This anti-rotation function develops the trunk stability needed for force transfer and spinal protection during athletic movements.

137. D — The snatch requires receiving the bar overhead with locked arms in a deep squat. Overhead squat mobility assessment verifies the athlete can maintain a stable, locked-arm position with the

bar directly overhead while squatting to full depth with an upright torso. Without this mobility, the snatch cannot be safely performed.

138. A — A baseball pitcher needs explosive rotational power (for the throwing motion) and anti-rotation stability (for deceleration and spinal protection). Medicine ball rotational throws develop the power component, while Pallof press variations develop the stability component. Both are essential for pitcher performance and health.

139. B — A properly performed push-up maintains a straight line from head to heels with core braced, the chest touches or nearly touches the floor, and the elbows track at approximately 45 degrees from the torso. This position maximizes training stimulus while protecting the shoulder from impingement at extreme elbow flare angles.

140. C — Cable 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, postural balance, and injury prevention in athletes who perform heavy pressing movements.

PROGRAM DESIGN (Questions 141–184)

141. D — The 400-meter sprint (45-55 seconds) relies primarily on the glycolytic system for sustained high-intensity ATP production throughout the race, supplemented by the phosphagen system for the explosive start and initial acceleration. Conditioning must target both energy systems to prepare for the full duration of the event.

142. A — A structural exercise loads the axial skeleton (spine) directly and requires the trunk musculature to maintain postural integrity under load. The barbell front squat meets both criteria — the bar creates compressive forces through the spine, and the core must actively stabilize the trunk throughout the movement.

143. C — The power snatch is the explosive/power exercise requiring the highest neuromuscular coordination and must be performed first when the athlete is freshest. The remaining exercises follow in descending order: core multi-joint → assistance → core stability.

144. B — Novice athletes benefit most from 2-3 total-body sessions per week with moderate loads, higher repetitions, and emphasis on technique mastery. This frequency provides adequate training stimulus while allowing sufficient recovery for the rapid neural and structural adaptations that characterize early training responses.

145. D — Loads ≥85% 1RM for ≤6 repetitions with 2-5 minutes of rest primarily develop maximal strength through neural adaptations: increased motor unit recruitment, improved rate coding, enhanced intermuscular coordination, and reduced antagonist co-contraction. The heavy loading forces high-threshold motor unit activation.

146. A — 72% of 160 kg = 115.2 kg, rounded to approximately 115 kg per working set. This moderate load with 10 repetitions and 75-second rest falls within the classic hypertrophy training zone, providing mechanical tension and metabolic stress for muscle growth.

147. C — Rest periods of 30-90 seconds for hypertrophy maintain elevated metabolic stress (lactate, H^+ accumulation) and the acute hormonal environment (GH, testosterone elevation) that support the growth stimulus. The incomplete recovery sustains the metabolic conditions that contribute to the hypertrophic signaling cascade.

148. B — DUP varies intensity and volume on a daily or weekly basis within each training week (e.g., hypertrophy Monday, strength Wednesday, power Friday), rather than across multi-week sequential phases as in linear periodization. This provides more frequent exposure to different training stimuli within each week.

149. D — Block periodization sequences: accumulation (high volume for work capacity and structural development) → transmutation (higher intensity for sport-specific strength and power) → realization (low volume for peaking at competition). Each block builds on the adaptations of the preceding one.

150. C — Maintaining intensity at preparatory-period levels while reducing volume and frequency preserves the neural and muscular stimulus needed to maintain strength and power. Research consistently shows intensity is the most critical variable for preventing detraining — volume and frequency can be substantially reduced.

151. A — A 12-week linear periodization model progresses from hypertrophy/endurance (high volume, moderate intensity) through strength (moderate volume, high intensity) to power/peaking (low volume, very high intensity). Volume decreases while intensity increases across sequential phases.

152. B — Three progressive loading weeks (42K → 46K → 50K) followed by a reduced week (32K) represents a deload/unloading week. This planned reduction allows accumulated fatigue to dissipate while maintaining enough stimulus to preserve adaptation, preparing the athlete for the next loading cycle.

153. D — Peak power in the jump squat occurs at 0-30% of back squat 1RM because lighter loading allows the high contraction velocities needed to maximize the velocity component of the power equation. Heavier loads increase force but reduce velocity below the threshold for peak power expression.

154. C — The hang clean achieves peak power at 70-80% of 1RM because it is a ballistic exercise where the load is accelerated throughout the entire range of motion. Sufficient mass is needed for meaningful force production, while the velocity must remain high enough for peak power — this loading range optimizes both.

155. A — Beginner athletes should start with 80-100 foot contacts per session distributed across exercises of varying intensity. This volume provides an initial training stimulus while limiting

eccentric loading on musculotendinous structures not yet conditioned for high-impact plyometric training.

156. B — Plyometric sessions should be performed at the beginning of the session after a thorough warmup when the athlete is fresh. Maximal effort and proper technique are essential for quality-based power training — fatigue from prior exercise degrades explosive output and compromises landing mechanics.

157. D — High squat strength (85th percentile) with low vertical jump (35th percentile) indicates a rate of force development deficit. The athlete has adequate maximal force capacity but cannot express it rapidly. Explosive training (plyometrics, Olympic lifts, jump squats) develops the ability to produce force quickly.

158. C — Soccer matches involve 90 minutes of mixed demands requiring aerobic base training (sustained play), anaerobic interval training (repeated sprints), and reactive agility conditioning (direction changes in response to opponents). Each component addresses specific physical demands of the sport.

159. A — The transition period lasts 2-4 weeks of unstructured, low-intensity active recovery focused on physical restoration, psychological renewal, minor injury treatment, and motivation renewal before the next preparatory period begins.

160. B — Return to play requires objective criteria: bilateral symmetry within 10% on relevant tests, sport-specific movement competency, and medical clearance. Subjective feelings alone are insufficient — persistent asymmetries exceeding 10% are associated with elevated reinjury risk.

161. D — Hockey shifts of 45-60 seconds with 2-3 minutes of rest represent glycolytic-dominant demands. Interval training matching these work durations and rest periods targets the glycolytic system specifically, producing the most transferable conditioning adaptations for hockey's shift-based play pattern.

162. C — An advanced athlete with 6 years of experience preparing for a single competition requires block periodization's concentrated, targeted stimuli. The accumulation-transmutation-realization sequence provides precise control over the training emphasis, with the realization block timed for peak performance at the competition.

163. D — The principle of accommodation predicts that the response to a constant stimulus diminishes over time. After 20 weeks of identical programming, introducing variation in exercises, loads, volumes, or periodization model provides novel stimuli that overcome the adaptation plateau.

164. A — Hamstring reconditioning progresses: low-intensity ROM restoration → progressive resistance training → sport-specific movements (sprinting, cutting) → unrestricted return based on objective bilateral symmetry criteria (within 10%). Each stage builds on the previous, with objective criteria gating progression.

165. D — Block periodization sequences: accumulation (high volume/moderate intensity) → transmutation (higher intensity/sport-specific) → realization (low volume/peaking). Each block builds on prior adaptations to produce peak performance at the target competition.

166. C — Muscular endurance training uses rest periods of 30 seconds or less to maintain elevated metabolic demand throughout the session. Short rest prevents full recovery, forcing muscles to sustain work under metabolic fatigue — the specific adaptation being trained.

167. B — Five sets of 2 at 92% 1RM with 5-minute rest is a maximal strength/neural adaptation protocol. Near-maximal loading recruits the highest-threshold motor units, and complete recovery ensures maximal force on every repetition — the essential stimulus for neural strength development.

168. A — 87% of 200 kg = 174 kg per working set. Five sets of 3 at this load with 4-minute rest represents a classic heavy strength protocol targeting neural adaptation through maximal motor unit recruitment and rate coding improvement.

169. D — Combining heavy strength 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. Both are needed for sprinting.

170. C — The general preparation phase builds a broad foundation of hypertrophy, general strength, work capacity, and aerobic fitness using varied exercises and methods. This base supports the more specific, intense training that follows during specific preparation.

171. A — During specific preparation, emphasis shifts to sport-specific qualities: power, speed, agility, and sport-specific conditioning. Exercise selection becomes more targeted, and training methods more closely replicate the competitive demands identified in the needs analysis.

172. B — Volume load = sets × reps × load = 4 × 8 × 100 = 3,200 kg. This is the standard calculation for quantifying total training work, used for tracking progressive overload and comparing training phases.

173. D — Pull-ups and rows develop pulling strength, dead hangs and farmer's carries develop grip endurance, anti-extension/anti-rotation exercises develop trunk stability, and nutritional guidance supports body composition optimization. This combination directly addresses all identified climbing-specific needs.

174. C — Reducing from two sessions to one increases detraining risk if the single remaining session cannot maintain adequate intensity and total stimulus. While some research supports brief maintenance on one session, the narrower margin for error means that any compromise in the remaining session's quality could result in strength loss.

175. A — Novice athletes benefit from moderate loads (60-70% 1RM) with higher repetitions (10-15) during the first 4-6 weeks. This develops movement proficiency through multiple repetitions, builds work capacity, allows connective tissue adaptation, and establishes the neural and structural foundation for heavier loading.

176. D — The 48-72 hour recovery requirement allows adequate recovery of musculotendinous structures experiencing significant eccentric loading during plyometrics. Tendons and connective tissues require more recovery time than muscle and are at risk for overuse injury if plyometric sessions are too frequent.

177. B — Sprint intervals of 5-10 yards with 25-40 second rest exactly replicate the offensive lineman's position demands — short maximal efforts with sport-specific recovery. This targets the phosphagen system at the actual work-to-rest ratio experienced during competition.

178. C — The correct annual sequence is: general preparation (broad fitness base) → specific preparation (sport-specific qualities) → competition (peaking and maintenance) → transition (recovery). Each period builds on the preceding one, progressing from general to specific to competition readiness.

179. A — Four sets of 12 at 70% 1RM with 60-second rest is a classic hypertrophy protocol. The moderate load provides mechanical tension, the higher repetitions and short rest create metabolic stress, and the combined stimulus drives the protein synthesis and cellular signaling that produce muscle growth.

180. D — Three-minute rounds of sustained fighting fall within the glycolytic-dominant range. The glycolytic system provides primary ATP during each round, while the phosphagen system powers explosive individual techniques and the aerobic system supports between-round recovery.

181. B — An athlete returning from 8 weeks of complete detraining should begin at significantly reduced intensity and volume with gradual progressive increases. Training status has declined, connective tissues have lost adaptation, and returning too aggressively increases injury risk substantially.

182. C — DUP's primary advantage is more frequent exposure to different training stimuli within each week (hypertrophy, strength, power). This variation may prevent accommodation to a single training zone and allows simultaneous development of multiple physical qualities.

183. A — Belt squats, leg press, goblet squats with modified grip, and other exercises that bypass the conventional barbell grip maintain lower body training while accommodating the wrist injury. Eliminating all training leads to unnecessary detraining of uninjured regions.

184. D — A decathlete's 10 events require simultaneous development of multiple diverse qualities. Concurrent training with undulating periodization provides the framework for addressing sprint speed, endurance, jumping power, throwing power, and skills in parallel throughout the training year.

TESTING AND EVALUATION (Questions 185–206)

185. C — The vertical jump (CMJ) using a Vertec is valid (measures lower body power), reliable (consistent results with standardization), practical (efficient for 40 athletes in 90 minutes), and requires only a Vertec device. It is the most appropriate field assessment for this scenario.

186. B — Reliability is the consistency and reproducibility of test scores across repeated administrations under identical conditions. High reliability means observed score changes likely reflect true performance improvement rather than measurement error from inconsistent testing procedures.

187. A — The 1RM is the last weight successfully lifted with acceptable technique through the full range of motion. The athlete completed 120 kg but failed at 125 kg, so 120 kg is recorded. Failed attempts are never counted as the 1RM regardless of how close to completion.

188. D — The 10 cm difference between CMJ (60 cm) and SJ (50 cm) reflects the athlete's stretch-shortening cycle utilization. The countermovement stores elastic energy and activates the stretch reflex, contributing additional force during the concentric phase that is unavailable during the static jump.

189. C — The beep test requires only cones and a sound system, can be administered to groups simultaneously, and provides a valid estimate of aerobic capacity. Its externally paced, progressive-intensity protocol with repeated direction changes makes it particularly suitable for team sport athletes.

190. B — The two-step calculation: (1) skinfold thicknesses are entered into population-specific prediction equations to estimate body density, then (2) body density is converted to body fat percentage using equations such as the Siri formula. Both steps are required for the final estimate.

191. A — BIA measures body composition through electrical impedance, which is significantly affected by hydration status. Dehydration increases resistance and overestimates body fat; hyperhydration decreases resistance and underestimates it. Consistent hydration across testing sessions is essential for reliable results.

192. 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 significant proportion of total time and can obscure real performance differences between athletes.

193. C — A 21% asymmetry substantially exceeds the 10-15% clinical threshold. This magnitude warrants targeted corrective programming emphasizing the weaker leg and possible medical evaluation to identify underlying pathology or incomplete rehabilitation contributing to the deficit.

194. B — The vertical jump (35th percentile) is disproportionately low relative to high squat strength (82nd percentile), indicating a rate of force development deficit. Programming should prioritize

explosive training (plyometrics, Olympic lifts, jump squats) to develop the ability to express strength rapidly.

195. A — Identical conditions across sessions — same warmup, equipment, test order, time of day, environmental conditions — is the most critical factor ensuring that observed score changes reflect true performance improvement rather than measurement error from inconsistent procedures.

196. D — At 88%, the surgical leg hasn't met the 90% bilateral symmetry threshold. The athlete should continue progressive strengthening because the 12% asymmetry is associated with elevated reinjury risk. Return to unrestricted competition should be withheld until the criterion is met.

197. C — The T-test involves forward sprint (10 yards), lateral shuffle in both directions (5 yards each way), and backward run (10 yards) arranged in a T-shaped pattern. It assesses multidirectional movement including forward, lateral, and backward capabilities.

198. B — Prediction equations are most accurate when repetitions are 10 or fewer because the relationship between reps and 1RM becomes less linear at higher counts. Factors like muscular endurance, pain tolerance, and motivation introduce variability not captured by the equations.

199. A — Force plates measure peak GRF, rate of force development, impulse, and power output in addition to jump height. This comprehensive data set provides detailed biomechanical analysis impossible with simpler methods (Vertec for reach only, jump mats for flight time only).

200. D — Testing at the beginning and end of each major training phase and at pre/post-season provides sufficient data to track progress and evaluate program effectiveness without excessive training disruption. Standardized intervals enable meaningful longitudinal comparison.

201. C — The sit-and-reach primarily measures hamstring and lower back flexibility, does not assess other joints, and is influenced by limb proportions (arm-to-leg-to-trunk ratio). For joint-specific flexibility assessment, goniometry is the preferred alternative.

202. B — Goniometry provides joint-specific range of motion 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 an athlete's movement.

203. A — Changes should be compared to each test's known measurement error (standard error of measurement) to confirm they exceed normal variability. Evaluating percentile changes against normative data provides context for the practical significance of the improvement.

204. D — A squat at only 1.2× body weight falls below the recommended 1.5× threshold for plyometric effectiveness. Heavy resistance training should be added to develop the strength foundation that enables plyometrics to produce power gains. Without adequate strength, the SSC cannot be effectively loaded.

205. C — Both tests require athletes to self-pace at maximal effort for the entire duration. Performance depends heavily on motivation, pacing experience, and willingness to tolerate sustained

discomfort. Athletes unfamiliar with self-pacing may produce results that underestimate true aerobic capacity.

206. B — The standardized 1RM protocol includes 3-4 progressively heavier warmup sets (approximately 50%, 70%, 80-85% of estimated 1RM) before beginning single-repetition maximal attempts. This progressive loading prepares the neuromuscular system and rehearses the movement at increasing intensities.

ORGANIZATION AND ADMINISTRATION (Questions 207–220)

207. A — Using the NSCA minimum guideline: 60 athletes × 40 sq ft = 2,400 square feet minimum. Using the upper guideline: 60 × 60 = 3,600 sq ft. The minimum is 2,400 sq ft, with 3,600 sq ft providing more comfortable spacing and equipment accommodation.

208. D — EAPs should be rehearsed at least annually with all staff participating, and ideally more frequently. Unrehearsed plans fail under emergency stress because staff may not know their roles, equipment locations, or communication procedures. Regular rehearsal builds the familiarity needed for effective response.

209. C — CPR and AED certification ensures every CSCS professional can provide immediate life-saving intervention for cardiac emergencies. Cardiac arrest survival rates decline approximately 10% per minute without CPR and defibrillation, making this competency critical for anyone supervising physical activity.

210. B — The standard of care is the degree of care, skill, and diligence that a reasonably competent professional with similar training and experience would exercise under similar circumstances. It represents the minimum competence expected in the profession — not perfection.

211. A — Waivers generally do not protect against gross negligence or reckless conduct — willful disregard for safety beyond ordinary carelessness. While waivers document that inherent risks were disclosed and voluntarily assumed, they cannot absolve professionals who demonstrate reckless behavior.

212. D — Diagnosing chronic knee pain and prescribing rehabilitation exercises are outside the CSCS scope of practice. These functions require the training and licensure of physicians, athletic trainers, or physical therapists. The specialist should refer to the appropriate qualified medical professional.

213. C — The CSCS scope encompasses designing periodized programs, teaching exercise technique, administering performance assessments, and managing the training facility. Diagnosing injuries, prescribing rehabilitation, creating individualized meal plans, and providing psychological counseling all require separate professional credentials.

214. B — Damaged equipment must be immediately removed from service, tagged out of order, documented in maintenance logs, and repaired or replaced before returning to use. Continued use violates the duty to maintain a safe environment and creates significant liability exposure.

215. A — The CSCS must decline unsafe practices, explain the evidence-based rationale, and advocate for athlete safety. The certified professional has ultimate responsibility for the strength and conditioning program and cannot implement demands that violate professional standards or endanger athletes.

216. D — Supervision ratios should be adjusted based on exercise complexity (Olympic lifts need closer supervision than machines), athlete experience (novices need more supervision), and staff qualifications (more qualified supervisors can manage larger groups). These factors collectively determine the appropriate ratio.

217. C — Comprehensive records include training logs, testing data, signed waivers, medical clearance forms, equipment maintenance records, and incident reports. These support effective programming and provide legal documentation of standard of care and informed consent.

218. B — 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 both athletes and the institution.

219. A — Footwear policies protect athletes from injury by dropped weights and equipment. Open-toed sandals provide no foot protection. The policy must be enforced consistently — the athlete must return with proper closed-toe athletic shoes before being permitted to train.

220. B — The NSCA's professional standards establish that the CSCS has ultimate professional authority and responsibility for the strength and conditioning program. While collaboration with sport coaches is essential, the certified professional makes final decisions about program design based on their specialized expertise.