Advanced Exercise Science Concepts

Exercise Science · Answer Key · 19 Questions

1. Which of the following cellular adaptations is primarily responsible for the enhanced fatigue resistance observed in endurance-trained individuals, mediated by increased mitochondrial density and oxidative enzyme activity?

A) Hypertrophy of fast-twitch muscle fibers
B) Increased satellite cell proliferation
C) Enhanced capacity for aerobic ATP production
D) Upregulation of sarcoplasmic reticulum calcium ATPase (SERCA)

2. During high-intensity interval training (HIIT), the predominant energy system utilized to sustain repeated bursts of maximal effort, especially those lasting 30-60 seconds, is:

A) Oxidative phosphorylation
B) The phosphagen system (ATP-PCr)
C) Glycolysis (anaerobic)
D) Lipolysis

3. The phenomenon of post-exercise oxygen consumption (EPOC), often referred to as the "afterburn effect," is largely attributed to the energetic cost of:

A) Increased metabolic rate due to elevated body temperature
B) Replenishing intramuscular ATP and PCr stores
C) Clearing accumulated lactate and restoring oxygen reserves
D) Increased hormone secretion, such as adrenaline and noradrenaline

4. In the context of resistance training, the concept of "progressive overload" is most effectively achieved by systematically increasing:

A) The number of repetitions per set
B) The duration of rest periods between sets
C) The intensity (e.g., weight lifted) or volume (e.g., sets x reps)
D) The frequency of training sessions per week

5. Which neurotransmitter plays a crucial role in initiating and controlling voluntary muscle contractions by binding to acetylcholine receptors at the neuromuscular junction?

A) Serotonin
B) Dopamine
C) GABA (Gamma-aminobutyric acid)
D) Acetylcholine

6. The lactate threshold is a physiological marker that represents the exercise intensity at which:

A) Glycogen stores are completely depleted
B) Blood lactate accumulation begins to increase exponentially
C) Oxygen uptake plateaus
D) Heart rate reaches its maximum

7. Which principle of biomechanics describes the tendency of a body to resist changes in its state of motion, and is directly related to the mass of the object being moved?

A) Action-reaction
B) Leverage
C) Inertia
D) Torque

8. During prolonged aerobic exercise, the primary fuel source shifts from predominantly carbohydrates to fats due to:

A) Decreased circulating insulin levels
B) Increased activity of hormone-sensitive lipase
C) Reduced availability of intramuscular glycogen
D) All of the above

9. The "size principle" of motor unit recruitment states that motor units are recruited in order of:

A) Their speed of contraction, from slow to fast
B) Their force-producing capacity, from low to high
C) Their fatigability, from fatigue-resistant to easily fatiguing
D) Their location within the muscle belly

10. Which ergogenic aid, when ingested and supplemented with carbohydrates, has been scientifically proven to enhance high-intensity, short-duration exercise performance by increasing the phosphocreatine stores in muscles?

A) Beta-alanine
B) Sodium bicarbonate
C) Creatine monohydrate
D) Caffeine

11. The "all-or-none" principle of muscle fiber contraction refers to the fact that:

A) A muscle fiber will either contract to its full extent or not at all
B) An entire motor unit will fire simultaneously
C) A muscle group will contract with maximum force or not at all
D) A muscle fiber can only contract if stimulated by a motor neuron

12. Which of the following hormonal responses is typically observed after acute resistance exercise, contributing to muscle protein synthesis and repair?

A) Increased cortisol levels
B) Decreased insulin-like growth factor 1 (IGF-1) levels
C) Increased testosterone and growth hormone levels
D) Decreased insulin levels

13. The primary mechanism for heat dissipation during exercise in a cool environment is:

A) Conduction
B) Convection
C) Evaporation
D) Radiation

14. Which type of muscle contraction involves the generation of force without a change in muscle length, often seen when holding a weight stationary?

A) Isotonic (concentric)
B) Isotonic (eccentric)
C) Isometric
D) Isokinetic

15. Cardiovascular adaptations to endurance training, such as increased stroke volume and reduced resting heart rate, are primarily mediated by:

A) Increased sympathetic nervous system activity
B) Increased myocardial contractility and improved ventricular filling
C) Reduced blood volume
D) Decreased capillary density in skeletal muscle

16. The rate of perceived exertion (RPE) scale, such as the Borg scale, is a subjective measure used to quantify:

A) The absolute workload being performed
B) The individual's physiological response to exercise
C) The intensity of exercise based on subjective feeling
D) The efficiency of oxygen utilization

17. Which of the following is a key determinant of the potential for skeletal muscle hypertrophy (growth)?

A) Increased mitochondrial biogenesis
B) Sufficient mechanical tension and metabolic stress
C) Enhanced aerobic enzyme activity
D) Reduced satellite cell activation

18. The "FITT principle" is a framework for designing exercise programs. What does the 'T' in FITT stand for?

A) Target Heart Rate
B) Temperature
C) Time
D) Type

19. During strenuous exercise, the body primarily relies on which substrate for energy when oxygen availability is limited?

A) Free fatty acids
B) Ketone bodies
C) Glucose (via glycolysis)
D) Amino acids