Name: _____ **Date:** _____

Answer Key: How Does Cellular Respiration Power Performance? 12th Grade Physiology Quiz

Bioenergetic stoichiometry, the sliding filament theory, and lactate threshold dynamics — essential concepts for analyzing human athletic potential.

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1. During a high-intensity cycling interval above the functional threshold power (FTP), what is the primary cause of muscular fatigue in the quadriceps as acidosis increases?

Answer: B) Interruption of calcium ion binding to troponin due to H+ accumulation

Accumulation of hydrogen ions (H+) during anaerobic glycolysis lowers intramuscular pH, which competes with calcium for binding sites on troponin, hindering muscle contraction.

2. The Frank-Starling Mechanism explains how an increase in left ventricular end-diastolic volume leads to a more forceful cardiac contraction.

Answer: A) True

This mechanism describes the relationship between the stretch of the ventricular walls (preload) and the subsequent stroke volume, which is a key acute response to exercise.

3. The specific training adaptation characterized by an increase in the number and size of mitochondria within Type I muscle fibers is known as ___.

Answer: A) Mitochondrial biogenesis

Mitochondrial biogenesis is a chronic adaptation to aerobic training that enhances the muscle's capacity to oxidize fatty acids and pyruvates.

4. Which enzyme acts as the 'rate-limiting' step during the fast glycolytic pathway, inhibiting energy production if pH drops significantly?

Answer: C) Phosphofructokinase (PFK)

PFK is the primary rate-limiting enzyme in glycolysis; its activity is inhibited by high levels of ATP or low pH values.

5. During the 'Oxygen Deficit' phase at the onset of exercise, the body primarily relies on ___ to meet energy demands before reaching a steady state.

Answer: C) Phosphagen and fast glycolytic systems

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Oxygen deficit occurs because the aerobic system takes time to adjust; therefore, anaerobic pathways bridge the gap to provide immediate ATP.

6. Excess Post-exercise Oxygen Consumption (EPOC) remains elevated longer after a low-intensity walk than after a high-intensity interval session.

Answer: B) False

EPOC is significantly influenced by intensity; higher intensity exercise disrupts homeostasis more, requiring more oxygen for recovery processes like ATP restoration and hormone balancing.

7. An elite marathoner likely displays a 'right shift' in their Lactate Threshold curve. What does this indicate about their physiological profile?

Answer: C) They can maintain higher speeds without significant blood lactate accumulation

A right shift in the lactate threshold curve indicates improved aerobic efficiency, allowing the athlete to perform at higher intensities before metabolic byproducts accumulate.

8. The physiological phenomenon where hemoglobin's affinity for oxygen decreases in the presence of high CO_2 and low pH is called the ___.

Answer: A) Bohr Effect

The Bohr Effect allows more oxygen to be unloaded at the tissue level where metabolic activity (and thus CO_2 production) is highest.

9. Hypertrophy of the left ventricle is a common chronic adaptation in endurance athletes, resulting in increased stroke volume.

Answer: A) True

Known as 'Athlete's Heart,' this adaptation involves an increased ventricular chamber size and wall thickness to handle larger volumes of blood during exercise.

10. Which of the following describes the 'Size Principle' of motor unit recruitment during a progressively heavy lift?

Answer: B) Smaller, fatigue-resistant units are recruited before larger, high-force units

The Size Principle states that the central nervous system recruits small (Type I) motor units first, adding larger (Type II) units only as the force demand increases.