Name: _____ **Date:** _____

Answer Key: Your Mission to the Cellular Core: A 10th Grade Exercise Bioenergetics Quest

Synthesize complex data on mitochondrial biogenesis and metabolic pathways to predict how the human body optimizes performance under extreme physiological stress.

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1. During a high-intensity interval training (HIIT) session, your body experiences an oxygen deficit. Which physiological phenomenon explains the continued elevated oxygen consumption during your cool-down period?

Answer: B) Excess Post-exercise Oxygen Consumption (EPOC)

EPOC, often called 'oxygen debt,' is the measurable increase in rate of oxygen intake following strenuous activity to restore the body to its resting state.

2. Long-term endurance training leads to an increase in the size and number of _____, which enhances the cell's ability to produce ATP through oxidative phosphorylation.

Answer: C) Mitochondria

Mitochondrial biogenesis is a hallmark chronic adaptation to aerobic exercise, increasing the capacity for aerobic energy production.

3. The Frank-Starling Mechanism states that the heart's stroke volume increases in response to an increase in the volume of blood filling the heart (end-diastolic volume).

Answer: A) True

This mechanism describes how the stretching of the cardiac muscle fibers leads to a more forceful contraction, a key acute response to exercise.

4. A marathon runner hitting 'the wall' typically signifies the depletion of which specific energy substrate in the liver and skeletal muscles?

Answer: C) Glycogen

Glycogen depletion is the primary cause of fatigue in long-duration events as the body struggles to maintain the required rate of ATP resynthesis.

5. The respiratory exchange ratio (RER) is the ratio between the volume of CO_2 produced and O_2 consumed. An RER of 1.0 indicates the body is primarily burning _____.

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Answer: C) Carbohydrates

An RER of 0.7 suggests fat oxidation, while 1.0 indicates pure carbohydrate oxidation, reflecting higher intensity work.

6. Ventilatory Threshold 2 (VT2) represents the point where lactate begins to accumulate in the blood faster than it can be removed, often called the 'Point of No Return.'

Answer: A) True

VT2 is closely associated with the anaerobic threshold, where the intensity becomes unsustainable for long periods due to metabolic byproduct accumulation.

7. Which specific hormone, released during the 'fight or flight' acute response, stimulates glycogenolysis and increases cardiac output?

Answer: A) Epinephrine

Epinephrine (adrenaline) facilitates immediate energy mobilization and circulatory adjustments needed for high-intensity physical efforts.

8. The principle of _____ states that for physiological adaptations to occur, the body must be subjected to loads greater than those to which it is accustomed.

Answer: B) Overload

The Overload Principle is fundamental to exercise physiology, requiring incremental increases in stress to stimulate chronic adaptations.

9. In the Cori Cycle, which organ is responsible for converting lactate back into glucose to be used by the muscles?

Answer: C) Liver

The liver plays a critical role in metabolic recovery by recycling lactate into glucose via gluconeogenesis.

10. Chronic resistance training primarily results in hyperplasia, which is the creation of brand new muscle fibers, rather than hypertrophy of existing fibers.

Answer: B) False

In humans, muscle growth is almost exclusively due to hypertrophy (enlargement of existing fibers); hyperplasia is not a significant factor in human strength adaptations.