Name: _____ **Date:** _____

Extremophiles vs Pathogens: 12th Grade Microbiology Challenge

Can microscopic life thrive in boiling vents or survive antibiotic onslaughts? Analyze metabolic pathways and structural adaptations in diverse prokaryotes.

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1. The bacterial cell wall component peptidoglycan is targeted by beta-lactam antibiotics. Which organism would be naturally resistant to these drugs due to a lack of this specific polymer?

A. Staphylococcus aureus
B. Escherichia coli
C. Mycoplasma pneumoniae
D. Bacillus anthracis

2. Retroviruses, such as HIV, utilize the enzyme reverse transcriptase to integrate their RNA genome into the host's DNA as a provirus.

A. True
B. False

3. In the nitrogen cycle, the process of converting atmospheric N2 into ammonia (NH3) is primarily performed by specialized bacteria using the enzyme _____.

A. Nitrogenase
B. Ammoniase
C. RuBisCO
D. DNA Polymerase

4. Which mechanism of horizontal gene transfer involves the uptake of 'naked' DNA fragments from the surrounding environment by a competent bacterial cell?

A. Conjugation
B. Transduction
C. Binary Fission
D. Transformation

5. Prions are infectious agents composed entirely of misfolded proteins and contain no nucleic acids (DNA or RNA).

A. True
B. False

6. Archaea found in high-salinity environments, such as the Dead Sea, are specifically classified as _____.

A. Methanogens
B. Extreme Halophiles
C. Hyperthermophiles

D. Psychrophiles

7. When performing a Gram stain, what is the primary structural reason why Gram-negative bacteria appear pink/red rather than purple?

A. They have a thick layer of peptidoglycan that resists safranin.
B. Their outer membrane prevents crystal violet from entering the cell at all.
C. The thin peptidoglycan layer loses the crystal violet complex during decolorization.
D. They lack lipids in their cell walls, preventing dye retention.

8. Agrobacterium tumefaciens is frequently used in biotechnology to create transgenic plants because of its ability to transfer its _____ into the host plant's genome.

A. Mitochondria
B. Ti Plasmid
C. Capsid
D. Ribosomes

9. The Theory of Endosymbiosis suggests that mitochondria and chloroplasts originated as free-living prokaryotes that were engulfed by an ancestral eukaryotic cell.

A. True
B. False

10. During the lysogenic cycle of a bacteriophage, what is the state of the viral DNA?

A. It is immediately used to synthesize new virions until the cell bursts.
B. It is degraded by the host's restriction enzymes.
C. It is integrated into the bacterial chromosome as a prophage.
D. It remains in the cytoplasm as an independent plasmid.