

1. Briefly summarize the ways in which microorganisms obtain nitrogen from their environment. (10%)
2. What is active transport? (10%)
3. Does the internal pH remain constant despite changes in the external pH? How might this be achieved? Explain how extreme pH values might harm microorganisms. (10%)
4. Discuss the reasons why a culture might have a long lag phase after inoculation. (10%)
5. How would the following be best sterilized: (10%)
 - (A) glass pipettes and petri plates
 - (B) tryptic soy broth tubes
 - (C) Nutrient agar medium
 - (D) antibiotic solution
 - (E) wrapped package of plastic petri plates?
6. What sources of energy, other than sunlight, are used by microorganisms? (10%)
7. How do substrate-level phosphorylation and oxidative phosphorylation differ from one another? (10%)
8. Can fermentation products be used in identifying bacteria? (10%)
Give some examples if the answer is yes.
9. Explaining the following terms. (20%)
 - (A) Genetic engineering
 - (B) Polymerase chain reaction (PCR)
 - (C) Coenzyme
 - (D) Recombinant DNA technology
 - (E) Bioremediation
 - (F) Archaea
 - (G) Cometabolism
 - (H) Gram stain
 - (I) Anabolism
 - (J) Secondary metabolite