

\* (T) rue or (F) alse (2 points each)

1. Because filtration removes rather than destroys microorganisms, it does not truly sterilize the materials passing through the filter. (False)
2. When a young, vigorously growing culture of bacteria is transferred to fresh medium of different composition, the lag phase is usually short or absent. (False)
3. Competitive inhibition can be overcome by adding excess substrate. (True)
4. Oxygen is always required for the regeneration of NAD from NADH. (False)
5. Very few gram positive bacteria utilize the Entner-Doudoroff glycolytic pathway. (True)
6. Mitochondrial electron transport takes place on the inner mitochondrial membrane. (True)
7. In cocci, peptidoglycan synthesis occurs at one or, at most, a few sites with the principal growth zone occurring at the site of septum formation. (True)
8. The rate of biosynthesis is much slower than the rate of breakdown. (False)
9. Nitrogen fixation is used to store energy by ATP formation. (False)
10. Enzymes increase the rate of a reaction but do not alter equilibrium constants. (True)

Reductant, oxidant, MreB, FtsZ, SpnC, free energy, entropy, enthalpy, sterilizing agent, bacteriostatic, disinfectant, sanitizer, bacteriocidal, antiseptic agent, thermal death time (TDT), thermal death point (TDP), decimal reduction time (D value), z value, amphibolic, biosynthetic, anaplerotic, Entner-Doudorff, homolactic, heterolactic, ethanol, butanol, acetic acid, anaerobic, aerobic, respiratory, anoxygenic, oxygenic, 0, 1, 2, 3, 4, 5, 10, 12, 15, 18, 24, 27, 34, 36, 38

\* Fill the blank using given terms (2 points each)

11. The actin-like protein that seems to be involved in determining cell shape and chromosome movement is ( MreB ).
12. ( Amphibolic ) pathways are those that function both catabolically and anabolically.
13. Organisms that directly reduce almost all of their pyruvate to lactate are called ( homolactic ) fermenters.
14. Organisms that form lactate ethanol and CO<sub>2</sub> as end products of glucose metabolism are called ( heterolactic ) fermenters.
15. The time required to kill 90% of the microorganisms or spores in a sample at a specified temperature is the ( D value ).

16. The increase in temperature needed to reduce the decimal reduction time to 10% of its value is the ( **z value** ).
  17. The shortest period of time needed to kill all organisms in a sample at a specified temperature is the ( **TDT** ).
  18. The hypothesis that proton motive force drives ATP synthesis is called the ( **chemiosmotic** ) hypothesis.
  19. The net gain of ATP per molecule of glucose metabolized anaerobically in eucaryotes is ( **2** ).
  20. The net gain of ATP per molecule of glucose metabolized anaerobically via the Embden-Meyerhoff pathway in procaryotes is ( **2** ).
  21. The net gain of ATP per molecule of glucose metabolized pyruvate using Entner-Doudoroff pathway is ( **1** ).
  22. The theoretical maximum net gain of ATP per molecule of glucose metabolized aerobically in eucaryotes is ( **38** ).
  23. The photosynthetic production of one molecule of glucose requires ( **18** ) molecule(s) of ATP.
  24. How many molecules of ATP are needed to reduce one molecule of carbon dioxide to carbohydrate? ( **3** )
  25. The ( **reductant** ) is the electron donor in a redox reaction.
  26. The ( **oxidant** ) is the electron acceptor in a redox reaction.
  27. The change in ( **free energy** ) is the amount of energy in a system that is available to do work
  28. ( **Enthalpy** ) is the total energy change that accompanies a chemical reaction.
  29. ( **Germicide** ) kill(s) all pathogenic organisms and endospores.
  30. An agent that kills bacteria is referred to as ( **bacteriocidal** ).
  31. An agent that prevents the growth of bacteria without causing irreversible damage to the bacteria is referred to as ( **bacteriostatic** ).
- \* Define or describe following terms (2 points each).
32. The phenol coefficient: **A measure of disinfectant efficiency in which the disinfectant being evaluated is compared to phenol.**

33. Functions of pentose phosphate pathway: Providing ATP, NADPH and four- and five-carbon sugars for biosynthetic pathways
34. P/O ratio: The number of ATP molecules generated per atom of oxygen that is reduced when electrons are passed from NADH or reduced FAD (FADH) to dioxygen
35. Anaplerotic reactions: Reactions are used to replace TCA cycle intermediates that have been used to provide carbon skeletons for amino acid biosynthesis.
36. Metabolic channeling: the regulation of metabolic pathways is controlled by the location of metabolites and enzymes involved in the pathway.
37. Isoenzymes: are different enzymes that catalyze the same reaction but can be regulated independently of one another.
38. VBNC: viable but non culturable
39. Prosthetic group and cofactor: A nonprotein component of an enzyme that is loosely or tightly attached to the protein component
40. Disinfection, sanitization, and antisepsis: killing pathogens, controlling pathogens for public health standard, and controlling growth on living tissues
41. APS: adenosine-5'-phosphosulfate, high energy molecules can do substrate-level phosphorylation (equivalent to ATP)

\* Give a short answer for following questions

42. List four possible reasons for entry into stationary phase in microbial growth (4 points).  
Nutrient limitation, limited oxygen availability, toxic waste accumulation, critical population density reached

43. Calculate the mean growth rate and generation time of a culture that increase in the exponential phase from  $1 \times 10^2$  to  $1 \times 10^8$  in 10 hrs (5 points).

$$k = (\log(10^8) - \log(10^2)) / 0.301 \times 10 \text{ hrs} = 2.0 \text{ generation / hr, } g = 30 \text{ min/gen}$$

48. What are the toxic effects of oxygen? (5 points)

(Textbook p. 140), radicals, hydrogen peroxide, superoxide are produced during the oxidative respiration

49. How do aerobes and other oxygen-tolerant microbes protect themselves from these effects? (5 points)

p. 140 peroxidase, catalase, superoxide dismutase

50. How do substrate-level phosphorylation and oxidative phosphorylation differ? (5 points)

keywords: fermentation vs. respiration, final electron acceptors, generation of ATP...

51. Why is the light reaction in green bacteria, purple bacteria, and heliobacteria termed anoxygenic? (5 points) not using water as electron sources, not producing oxygen

52. What are four different pathways for CO<sub>2</sub> fixation? (4 points)

Calvin, rTCA, 3-hydroxypropionate, acetyl-CoA pathways