K. Sorensen Biol. 2200

Study Guide for Unit 2

1. Define growth in microbiology. Why do we study populations rather than individual cells?
2. Be able to draw a growth curve in a closed system (vessel). What is going on in each phase of the curve? Lag, log, stationary, death…
3. What is meant by exponential growth?
4. Understand and be able to use the following formula: $N_t=N_o$ X 2^n
5. Using the above formula, calculate the number of bacteria in a population at a given time.
6. Define balance and unbalanced growth and know how they would look on the growth curve.
7. What factors influence stationary phase.
8. Define doubling time.
9. Define growth rate.
10. Describe the following methods of measuring cell growth: Direct cell counts (counting chamber, electronic counters, membrane filters) and viable cell counts (spread plating, pour plating, membrane filtering-plating), and dry weight, and turbidity. Explain the advantages and disadvantages of each.
11. What is the purpose of a continuous culture?
12. Describe a chemostat culture. How does each of the components in the following equation affect the culture D=*f*/V?
13. Describe a turbostat culture.
14. Why and where would you use a continuous culture system?
15. Describe a_w and how does it affect growth?
16. Know generally the organisms that will survive under low a_w conditions.
17. Define a halophile and describe how it is able to survive under such conditions.
18. Define acidophile, neutrophile, and alkalophile. How are these organisms able to function under the extreme condition and know some examples of each?
19. What is meant by optimal growth curve using temperature and pH as examples?
20. Define psychrophile, mesophiles, and thermophiles. Know examples of each.
21. Define obligate aerobe, obligate anaerobe, microaerophile, facultative anaerobe, and aerotolerant.
22. Why is oxygen toxic to living things?
23. How do the SOD and catalase enzymes determine the oxygen requirement conditions?
24. How does pressure affect growth?
25. How does radiation affect growth?
26. What is the difference between ionizing and non-ionizing radiation? How does each work? Know examples of each.
27. How is UV radiation damage repaired in bacteria?
28. Is visible light an ionizing or non-ionizing radiation and how does it work? How do organisms protect themselves from visible light?
29. Define Leibig and Shelford's laws.
30. Are we able to culture all bacteria? How can we detect bacteria that we are unable to culture? Look up metagenomics.
31. What is quorum sensing and how does it work? What is a homoserine lactone?
32. Define sterilization, disinfection, antiseptic, sanitation, and describe conditions for using each.
33. Differentiate between cidal and static by definition and growth curve.
34. How do the following influence the effectiveness of an antimicrobial agent's activity? Population size, population composition, antimicrobial agent composition, duration of exposure, temperature, environment.
35. Describe the following and explain how each works to control microbes. Moist heat, dry heat sterilization, boiling water, incineration, pasteurization (LTLT, HTST, & UHT), freezing (freezer & liquid nitrogen), refrigeration, filtration (membrane and air), drying (salting, dehydration, and lyophilization), and radiation (UV and ionizing).
36. Define TDT, D value, Z value, and F value. Understand their relationship.
37. Why do we autoclave for 15 minutes at 121°C? Hint: We use *Bacillus steareothermophilus* as a control or indicator organism.
38. What does the freeze-thaw of meat do to your food?
39. How do chemical agents work?
40. Know the uses and mechanisms of action of the following chemical classifications: phenols, alcohols, halogens, heavy metals, quats, soaps & detergents, aldehydes, oxidizers (include the gases ethylene oxide & betapropiolactone), and dyes.
41. What is the phenol coefficient test and how is it computed?
42. What are antibiotics, an MIC, and a zone of inhibition?
43. What factors make for a larger zone of inhibition?
44. Define kinetic and potential energy.
45. Define chemical, transport, and mechanical work. What molecule is used as the energy in most of these?
46. Define calorie and joules.
47. Know the first and second law of thermodynamics and how it related to the metabolism.
48. Define ΔG, ΔH, T and ΔS in the free energy equation and understand how they relate to each other. When will reactions occur spontaneously?
49. Define chemical equilibrium and equilibrium constant.
50. Define $\Delta G^{o'}$.
51. What is ATPs role in metabolism?
52. What is a reductant? Oxidant? E_O? E'_O?

53. How do redox couples relate to each other? How does this affect organisms with difference electron acceptors?
54. Where does electron come from in heterotrophs, photoautotrophs, and chemoautotrophs?
55. Know the following electron carriers and their function in metabolism: NAD, NADP, FAD, FMN, CoQ, Cytochromes, and nonheme iron proteins (ferrodoxin).
56. What are enzymes and what is their function? Include apoenzyme, cofactor, holoenzyme & coenzymes.
57. What are the functions of enzymes and how do they work? Transition state?
58. How does pH and temperature affect enzymes?
59. Define K_m, V_{max}, 1/2 V_{max} and velocity.
60. What is a competitive and uncompetitive inhibitor? How do they affect K_m, V_{max}, 1/2 V_{max} and velocity?
61. Define metabolic channeling. How does it affect K_m, V_{max}, 1/2 V_{max} and velocity?
62. How are enzymes controlled and regulated?
63. What effect does allosteric regulation have on K_m, V_{max}, 1/2 V_{max} and velocity?
64. Define covalent modification of enzymes.
65. Describe feedback inhibition. Relate to ATP production.