Review & read Elements of Microbial Nutrition, Ecology & Growth in Chapter 7. Review & read Methods of Culturing Microorganisms on pages 59-72 (only) in Chapter 3. Study the questions below in study groups. Do multiple choice questions (Chapter 7: 1-7, 11-16, Chapter 3: 1-4 & 12), and the concept questions (Chapter 7: 1-20, Chapter 3: 1-4, 10,11) at the end of the chapter.

1. What is binary fission? Can you draw the events that occur in binary fission?
2. What is a generation time? Exponential/logarithmic growth? Which set of dividing cells in a series would be considered to be the first generation versus the zero generation?
3. Explain the components of a bacterial growth curve including death rates, metabolic rate, available nutrition, waste products and doubling time for each component. Relate this information to endospore formation, successful drug treatments, disinfectants and heat treatments.
4. Discuss the methods available for direct and indirect counting of microbes. What are the advantages and disadvantages of each method (ease of use, cost, accuracy, living cells, actual count or estimate)? Make sure you are able to do serial dilution calculations.
5. How do microbiologists count microbes when the numbers are too high or too low to count accurately?
6. How does the environment impact microbial growth? What are the requirements for psychrophiles, mesophiles, and thermophiles, halophiles, acidophiles and alkalinophiles? How does osmotic pressure affect cell growth? Applications?
7. Differentiate between obligate anaerobes/aerobes, facultative anaerobes, obligate anaerobes, aerotolerant anaerobes, and microaerophiles. Can you think of an environmental situation where each could be found?
8. What are the chemical requirements for growth? Be able to differentiate between organic and inorganic compounds. What are the macronutrients? Be sure to focus on C, N, S, P, and O. What molecules can these atoms be found in?
9. What are the micronutrients, trace elements & growth factors? How might they be supplied to a growing organism?
10. What carbon sources can be used for metabolism? What types of energy can be used for metabolism? Relate this information to the terms hetero/auto/chemo/photo/trophs and give some examples of each.
11. What types of associations occur between microbes including: free-living, symbionts, synergistic, antagonistic, mutualists, commensalists, saprophytes (saprobes), parasites, ectoparasites, endoparasites, intracellular parasites, obligate parasites.
12. In class we discussed how oxygen is both beneficial and harmful. Explain the mechanisms microbes have to overcome oxygen's harmful effects. What enzymes are important for oxygen requiring species? What special measures do microbiologists have to take when growing anaerobes?
13. How are pure cultures of microbes obtained? What type of chemical is agar? What is the difference between a mixed culture and a pure culture? How does a single colony originate? What are clones? What is the difference between a broth and an agar?
14. What is the purpose of a streak plate?
15. What are the different types of media that can be used to grow microbes? Distinguish between the terms synthetic, defined, nonsynthetic, complex, general, enriched, selective, differential, reducing, and buffered media. How are these types of media achieved in the laboratory? Can a specific medium be classified as more than one category? How would you classify nutrient agar? Tryptic soy agar? Sodium citrate broth? Sodium thioglycollate broth? Glucose broth? Blood agar? Chocolate Agar? Mannitol salt agar? Why are all types of media selective to a certain extent?

16. Can obligate intracellular parasites be grown on laboratory media? Have microbiologists been able to grow all microbes successfully in the laboratory?

Remember, you will not be turning these questions in to me, but they are critical for your success!