

**Microbiology 2400
Study Guide #7
Winter Semester 2008
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LABORATORY SECTION

OXYGEN AND BACTERIAL GROWTH

You should read the introductory material presented in your laboratory manual.

The Textbook reference for this set of questions is Chapter 6

1. As was noted in class, the world of bacteria can be subdivided into at least 3 major groups, based on their need for oxygen. What are these groups? You should be able to define each, in terms of their oxygen requirements.
2. In addition to the groups mentioned above, your textbook indicates several other groups, one of which is that known as the microaerophiles. You should be able to distinguish this group from the others.
3. You should be able to cite 1 example of a bacterial species that is capable of causing human disease and is an obligate anaerobic organism. Cite the disease that it causes.
4. 2 general means for obtaining anaerobic environments were mentioned in class. What were those approaches?
5. You were introduced to 2 chemical methods for obtaining anaerobic environments. What were they? You should be able to briefly describe each of these methods
6. The “anaerobic jar” set up creates not only an anaerobic environment but one which is rich in carbon dioxide. Of what general benefit is this to the medical microbiologist?
7. What is the function of the dye, resazurin, in media such as fluid thioglycollate medium?
8. What appears to be the effect of resazurin on the growth of *E. coli*?

9. In discussing the chemistry of why bacterial organisms may be obligate anaerobes, you were introduced to superoxide dismutase. What does this enzyme do? What is superoxide? What cellular process generates this material? One explanation for the existence of the obligate anaerobic bacterium is based on the absence of SOD (superoxide dismutase) describe the reasoning behind this explanation.
10. The tissues of the human body are essentially an aerobic (oxygen rich) environment. Puncture wounds can result in the development infections attributed to the presence of bacteria which are of the strict anaerobic type. Cite two factors resulting from puncture wounds which would help set up the necessary conditions for the growth of anaerobic bacteria in human tissue.
11. Your Textbook discusses a “candle jar”.
 - a. You should be able to describe this rather piece of equipment.
 - b. What kind of environment is produced by its use?

HEAT RESISTENCE OF BACTERIA

You should read the introductory material presented in your laboratory manual.

For textbook references, you will have to consult the index of your Textbook and your class notes concerning this exercise.

1. What were expected results of this exercise, in terms of the survivability of *E. coli*, and *B. cereus*. Why would you expect this result?

LECTURE SECTION

1. Some time was spent discussing, in general terms, the metabolism of proteins with the goal of ATP generation.
 - a. The first step in this type of protein metabolism, would be the conversion of the large protein molecule into its ___ subunits via the process of ___.
 - b. The next major step would involve the removal of the ___ group. This can occur several ways. What were the approaches that you were introduced to in class? You should be able to generally describe what occurs in each process noted above.
 - c. Each of the above-mentioned processes results in the production of what I called an ___ fragment. These fragments are then metabolized via the use of the ___ pathway of the ___ cycle which leads to the generation of ATP

2. Some time was spent discussing, in general terms, the metabolism of lipids (triglycerides) with the goal of ATP generation.
 - a. The first step in this type of lipid metabolism, would be the conversion of the triglyceride molecule into a single molecule of ___ and three molecules of ___ via the process of ___
 - b. At this point the single molecule of ___ would be altered slightly and then enter into the ___ pathway for final metabolism. The three molecules of ___ would be converted to small, 2 carbon fragments known as acetyl-CoA via a pathway known as ___. The acetyl-CoA molecules would be further metabolized via the ___ cycle.
3. Some time was spent discussing the process of photosynthesis. You should be able to write a general word equation to describe this process. (in its oxygenic form)
4. As was noted in class the photosynthetic process can be subdivided into 2 forms based on the production of oxygen. There is what is known as oxygenic photosynthesis, which is found in several microbial groups. What were those that were mentioned in class?
5. Anoxygenic photosynthesis is found in what major group of microorganisms? (Bacteria, Fungi, Eukaryotic algae or Protozoans)
6. In discussing anoxygenic photosynthesis, it was noted that water is not used in this process but rather other chemical substances take its place. What was the example cited in class (Note, it is probably the most common such substitution)?
7. Those organisms that conduct anoxygenic photosynthesis have only the so-called photosystem I. Their ability to generate the required NADPH_2 (for use in the dark reactions) is handled in several ways. You were introduced to two such methods. One of these involved certain members of the electron transport chain donating electrons directly to ___. The other method involved a process known as “reverse electron transport” Briefly, what is going on in this method?
8. When all is said and done, the light reactions of photosynthesis produce two “products” which are necessary for the dark reactions of photosynthesis to occur. What are these two “products”
9. There are several “schemes” by which the so-called dark reactions of photosynthesis can occur. Probably the most common of these is the ___ cycle. The key reaction in this pathway is the conversion of PGA to PGAL. This reaction requires the input of reducing power and energy. This requirement is fulfilled by what two substances? (hint, they are the light reaction products)
10. It was noted in class, that the above cycle is not the only form that the dark reactions can take. You were also introduced to another mechanism that some photosynthetic bacteria employ. This involved a reversal of the ___ cycle.

11. Oxygenic photosynthesis is conducted by what 2 major groups of microorganisms?
12. Anoxygenic photosynthesis is conducted by what major group of microorganisms?
13. It was noted that the world of life can be subdivided into 4 major groups based on their energy and carbon sources. You should be able to cite these groups and to define each in terms of their energy and carbon sources. Two of the groups were noted as having only bacterial members. What were those groups?
14. Some time was spent discussing *Thiobacillus thiooxidans*.
 - a. To which of the above-mentioned 4 groups does this organism belong?
 - b. What kind of microorganism is it?
 - c. This organism has a rather unusual means of obtaining its ATP in that it can oxidize ___ and use the energy released to form ATP. The waste product of this oxidation is ____. It was noted in class, that there is a “down” to this organism’s metabolism. This downside involved the production of _____ waste which has had a significant impact on ___ ecosystems in this country.
 - d. It was also noted that this organism’s metabolic activities can have a “good side” if properly managed. The “good side” was illustrated by the use of the bacterium in the early stages of ___.

The following is a question, which should have been incorporated into a previous study guide.

1. Given the fact that NADH (let us assume that the NADPH does not get involved in the production of ATP) leads to the production of 3 molecules of ATP, How many ATP molecules are produced via the metabolism of a single glucose molecule via the Entner-Doudoroff pathway. Yes, this pathway actually exists. See page 875 of your textbook. Note, for this type of question, I will provide the diagram of the pathway as indicated on page 833. It is not necessary to memorize this pathway.