

Directions: Please answer all questions in only the space provided, if you need more space your answer is WRONG. Please think out your answer before writing.

1. Explain how Francisco Redi (late 1600's) attempted to disprove the theory of Spontaneous Generation. You can outline his experiment. List one academic thing that came from this experiment. (8 points).

2. Suppose you decided that there is a bacterium in soil that could use far red light for a source of energy. Then you figure out how to make an enrichment medium: (12 points)

a. if sun light was to be the energy source you would have to _____
 sun light to illuminate the culture so that only far red light using bacteria could grow.
 The medium would most likely also have to eliminate _____.

b. For this medium you could use as media ingredients:

sulfur source: _____.

phosphate source: _____.

nitrogen source: _____.

carbon source: _____.

c. You added these ingredients so that the (fill-in the blank with one word only).

carbon source would be converted to: _____.

nitrogen source would be converted to: _____.

sulfur source would be converted to: _____.

phosphate source would be converted to: _____.

3. Write out Koch's second postulate (and ONLY that). (5 points)
4. The magnification of a microscope using a 10X objective and a 8X ocular lens with a 4X condenser lens is:_____X. (5 points).
5. Suppose you were presented with two 40X lenses to use on your microscope, lens A had a numerical aperture of 0.56 and lens B had a numerical aperture of 0.75. Which is best and Why? (8 points)
6. The energy source for ABC transporters is: _____ . (4 points)
7. Diagram the peptidoglycan unit that includes and spans two sugar backbones in a Gram negative bacterium. Use D-ala for D-alanine, L- ala for L-alanine, GN for N-acetylglucosamine, MA for N-acetyl-muramic acid, L-W for L-tryptophan, D-glu for D-glutamic acid, L- glu for L-glutamic acid, meso-DAP for meso-diaminopimelic acid, D-lys for D-lysine, L-lys for L-lysine, N-orn for N-ornithine, gly for glycine (amino acetic acid). (16 points).

8. Diagram a Gram positive heterotrophic bacterial cell. Label the peptidoglycan, cytoplasmic membrane, ribosomes, DNA, and mitochondria. (12 points)

9. See the attached "electron tower". Suppose you isolated a bacterium that could oxidize glucose by respiration, but could not use oxygen as the terminal electron acceptor. Instead, this bacterium had the ability to reduce iron as the terminal electron acceptor. What is the $\Delta E_o'$ for this oxidation? (5 points).

10. Consider that ATP has 30.5 kJ/mole in its terminal phosphate (the so called high energy bond). How many ATPs are theoretically possible to form from the oxidation of one methanol to CO_2 and water. The Faraday constant is $96.5 \text{ kJ}\cdot\text{volt}^{-1}\cdot\text{mole}^{-1}$. (5 points).

11. You were doing a growth curve experiment with the pure culture you obtained in question 9 and got the following data:

Time	Titer (CFU/ml)
8 AM	3×10^7
9 AM	7×10^7
10 AM	1.67×10^8
11 AM	3.95×10^8
noon	8.9×10^8
1 PM	2.05×10^9
2 PM	2.2×10^9
3 PM	2.4×10^9

a. On the graph paper attached, graph this growth curve. Make sure to remember all the rules about making a graph. (8 points).

b. Calculate the growth rate and generation time (12 points).