

Biology 230 Exam Cover Sheet

Do no open the exam until instructed to do so.

Complete the first portion prior to opening the exam.

Name (please print): _____

Signature: _____

Student ID: _____

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Name (please print): _____

Signature: _____

1. Which of the following facts regarding cells is correct?
 - a. heredity is passed on in the protein found in chromosomes.
 - b. The nucleus and mitochondria actually have 2 membranes around them.
 - c. Protozoan are complex cells capable of forming tissues.
 - d. The cytosol contains organelles such are lysosomes and mitochondria
 - e. All eucaryotic cells have a nucleus

2. Consider the microscopy of specimens. Which of the following couplets is incorrect?
 - a. living/ light microscopy
 - b. cross section/light microscopy
 - c. cross section/ SEM
 - d. staining/TEM
 - e. high resolution/SEM

3. A biologist uses yeast cells as a model for studying cancer. Which of the following is the least compelling (i.e. the least significance reason) for using yeast.
 - a. yeast reproduce rapidly
 - b. yeast are eukaryotic cells
 - c. yeast are commercially useful for making foods
 - d. yeast have similar enzymes of metabolism to humans
 - e. yeast are easy to cultivate

4. Consider the following statements regarding chemical bonding and mark all that are incorrect.
 - a. in water, ionic bonds are the strongest
 - b. an element with 7 electrons in its valence shell will likely grab another electron
 - c. polar covalent bonds occur when electrons are shared equally between atoms in the molecular bond
 - d. covalent bonds are the hardest to break of all bond types
 - e. van der Waal's forces are powerful over great distances.

5. Which of the following function groups is mis-paired with its structure?
 - A. C-C=O / ketone
 - b. C-OH/ alcohol
 - c. C-COOH/ carboxylic acid
 - d. PO₄/phosphate
 - e. NH₂/amine

6. True/False Nucleic acids are a unique class of organic macromolecules in that they only exist in the polymer form in the body (i.e. DNA and RNA)

7. Regarding the delta G of chemical reactions, which of the following statements is incorrect.
 - A. a negative delta G means that reaction could be spontaneous
 - b. the negative delta G means that reaction will occur
 - c. coupling of reaction can be used to overcome a positive delta G.
 - d. the delta G of a reaction can not be altered by enzymes
 - e. all of the preceding facts are correct.

8. True/False When electrons are transferred in redox reactions, the most abundant source of frequently co-transferred hydrogen ions are the large organic macromolecules nearby.

9. The functional group that most increases an organic compounds hydrophilic nature is:
 - a. Hydroxyl groups (-OH)
 - b. Carbonyl groups (-CO)
 - c. Carboxyl groups (-COOH)
 - d. Amino acids (-NH₂)
 - e. Fatty acid chains

10. Which of the following statements is correct:

- a. Polymers make up monomers
- b. Nucleic acids are the most diverse from of monomers
- c. Monosaccharides are joined by condensation reactions
- d. Hydrolysis joins monomers
- e. Monomers account for most of a cell's molecular uniqueness

11. Which of the following features determines the type of sugar:

- a. Location of carboxyl group
- b. Length of carbons (3-7)
- c. Spatial arrangement
- d. Carbonyl group location
- e. All of the above

12. The most complex series of reactions that occur with regards to metabolism is found with in the: a. fats b. carbohydrates c. nucleic acids d. proteins

13. True/False The shifting of hydrogen atoms is accomplished by compounds like NADH and NADPH

14. The high energy bond found in ATP is located in the a. 3rd external and 2nd external phosphate bond b. 2nd external and 1st external phosphate bond c. sugar/phosphate bond d. sugar/nucleic acid bond

15. True/False The contact between an enzyme and it substrate is largely determined by the simple rates of diffusion.

16. True/False Enzyme and cellular systems are poorly equipped to harness the energy from the instantaneous oxidation of an organic macromolecule.

17. Which of the following statements regarding photosynthesis and respiration is incorrect. a. photosynthesis involves reduction b. oxidation of glucose is the process occurring in respiration c. photosynthesis involves primarily exogonic (energy liberating) reactions d. respiration and photosynthesis both use water in their reactions. e. all of the preceding are true.

18. A substrate that closely resembles the normal substrate of an enzyme *could* affect an enzyme in all of the following ways except for: a. attach the active site and slow the enzymes progress b. attach to the allosteric site and slow the reactions progress c. attach to the active site and accelerate the reaction d. attach to the allosteric site and accelerate the reaction.

19. Which of the following reactions show the underlined atom undergoing an oxidation? Mark all that apply.

- a. Na--→Na⁺
- b. Cl--→Cl⁻
- c. C₃H₇OH--→C₃H₆O
- d. CH₃CH--→ CH₃COOH
- e. CH₂=CH₂----CH₃-CH₃

20. True/False Linking the reaction $X \rightleftharpoons Y$ to a second energetically favorable reaction $Y \rightleftharpoons Z$ will shift the equilibrium constant of the first reaction
21. Some reactions in glycolysis can generate ATP. This is due to high energy compound that exceed the delta G of $ADP \rightarrow ATP$. This functional group with the highest potential delta G is a. phosphoenol pyruvate b. 1-3 bisphosphoglycerate c. creatine phosphate d. mega master muscle fuel from GNC. e. ATP
22. Regarding the potential energy extracted from organic macromolecules, which of the following statements is incorrect? A. fats have the most potential energy of all OMMs b. the chemical oxidation of glucose actually yield less energy than the biological oxidation of glucose. c. the storage of water along with sugars means that on a per weight basis, sugar are a less efficient source of energy. d. fats can not be anaerobically metabolized.
23. True/False Phosphorylation is primarily accomplished in the Krebs's cycles. To put this another way, most of the ATP made in a cell is made in the Krebs's cycle.
24. Which of the following Krebs's cycle enzymes are not exergonic (energy producing) mark all that apply a. citrate to isocitrate b. alpha ketoglutarate to succinyl CoA c. succinate to fumarate d. malate to oxaloacetate e. oxaloacetate to citrate
25. The location of the Krebs's cycle is most accurately located in the: a. cytosol b. between mitochondria external and internal membrane c. inside the inner membrane of the mitochondria d. chloroplasts e. the Krebs's cycle is located in all of the preceding areas.

Written Portion IF YOU DO NOT UNDERSTAND A QUESTION, ASK FOR CLARIFICATION!!!!

1. (3pts) What is *Giardia*? Explain its two possible modes of evolution using arrow notation.

2. (1 pt ea) Define the role of the following in a cell:
Cytosol

Lysosomes

Endoplasmic reticulum

3. (6 pts) As a biotechnologist you design the perfect square bacterium and name in *Cubensis wolfii* in homage to your first biotech instructor. Assume that this bacteria is 10 μ m on one side and can fill a flask to a density of 10 percent by volume. SHOW YOUR WORK!

How many bacteria could survive in a 1 liter culture flask?

What is the surface to volume ratio of your new creation?

How does this compare to a spherical bacteria (the surface areas of sphere is $4\pi R^2$ and the volume is $\frac{4}{3}\pi R^3$).

Why would your new bacteria not compete to well again a spherical species of bacteria?

4. (3 pts) Demonstrate you knowledge of sugar structure by drawing the below requested sugars. Note; You only need to show the requested feature, not the complete structure of the molecule.

Hexose vs pentose Keytose vs aldose to isomers of triose

5.(3 pts) When water causes the dissolving of salt, specific interactions between the water molecules and ions of the salt. Diagram the interactions occurring when a single molecule of K_2CO_3 interacts with water molecules. Be sure to show charges and bonding.

6. (2pts) In order of strength in air and in water list the following bonds:

Covalent, ionic, polar covalent and hydrogen bonds.

Air: Strongest

Weakest

Water: Strongest

Weakest

7. (3 pts) What is the relationship of a bond's strength to its role in cell physiology?

8. (2 pts) Fats come in saturated and unsaturated forms. Comment on what makes a fat saturates vs. unsaturated and how these fats may influence the fluidity of the cell.

9. (3 pts) Carbon (atomic number 6, weight 12) and oxygen (atomic number 7, weight 14) can form CO_2 . Completely diagram this molecule showing all relevant atomic structures and the nature of their bonds.

10. (4 pts) Reference the Kreb's cycle located on the last page of this test. Assume that a oxaloacetate is labeled with a radioactive carbon as indicated by the asterisk (*). Show

the work to how your arrived at the conclusion as to which turn and which step this carbon is released as CO₂.

11. (3 pts) As a unifying event in the class, the CO₂ from my breath becomes part of your anatomy. Explain what steps would be requires to allow this to occur. Use arrow notation and you should show the majors steps, not necessarily the specific structures.

12. (6 pts) The enzyme complex required to convert pyruvate to Acetyl-S-Co-A is very large and consist of three distinct enzymes. Name three reasons as to why this particular reaction would benefit from such a large complex?

a.

b.

c.

Extra Credit

Explain how HPLC and gel filtration may be used together to isolated a particular sized non polar protein.