

Biochemistry 5700
Fall, 2006
Exam 2
October 25, 2006

INSTRUCTIONS:

Do not begin until 10:30 AM. The exam must be turned in by 11:20 AM. This exam should have 12 questions and 9 pages. Answer **all** questions completely, concisely, and legibly in the spaces provided. Good Luck!!

(1) Definitions. 20 points.

When relatively high concentrations of fatty acids are placed in water they form structures known as _____.
When relatively high concentrations of glycerophospholipids are placed in water they form structures known as _____.
How many stereoisomers are possible for the family of D-aldoses with seven carbon atoms?
Name the simplest carbohydrate that is an aldose
Linear sugars that are structurally identical except for the orientation of the hydroxyl and hydrogen at one position are called what?
The compound resulting from the nucleophilic addition of an alcohol to an aldehyde is called what?
What is the orientation of the nitrogenous base to the sugar in B-DNA?
What molecule is a membrane plasticizer?
The combination of nitrogenous base bonded to ribose is called a _____
The reaction of the side chain of lysine with acetone would produce what type of compound?
Which nitrogenous base is present in RNA but not DNA?
What type of sugar pucker is present in B-DNA?
Name a carbohydrate that is achiral
Ring-cyclized sugars that contain a free hydroxyl group at the anomeric carbon are called _____ sugars
Name the specific D-aldose in which ALL hydroxyl groups lie in the equatorial plain
What vitamin is associated with vision?
What vitamin is associated with regulating calcium uptake for bone formation?
The relations $A = T$ and $G = C$ are called what?
Name a general role for lipids other than serving as an energy reserve or structural component of membranes
What conformation does double stranded RNA form in solution?

(2) (15 points) In the space provided, describe the structural properties and biological functions of the following polysaccharides. You need not draw structures.

(a) peptidoglycan

(b) chitin

(c) glycosaminoglycan

(d) amylopectin

(e) cellulose

(3) (10 points) Membrane transport. Answer either of the following questions in the space provided. You choose which question to answer. ANSWER ONLY ONE OF THEM! Feel free to use diagram(s) to assist in answering the question

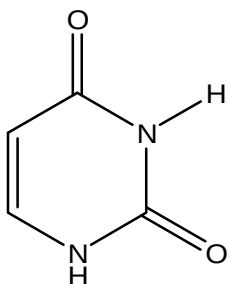
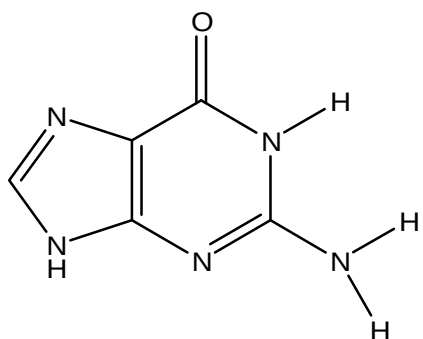
Option 1: Provide a detailed description of the transporter mechanism employed to transport Na^+ out of cells and K^+ in.

Option 2: Provide a detailed description of how CO_2 produced in the tissue is processed and exported to the lung where it is expelled in your breath.

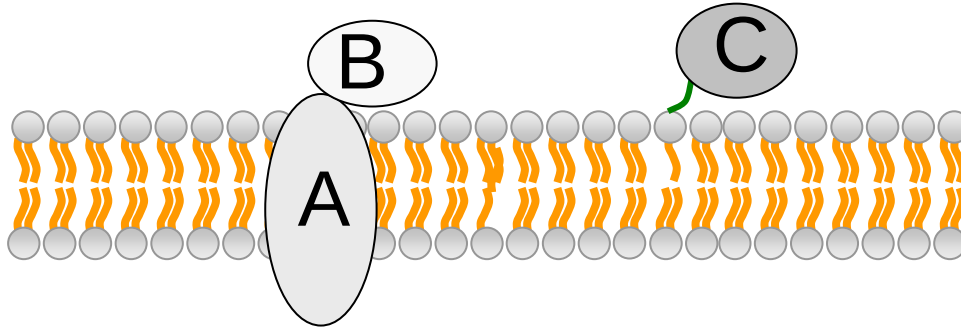
(4) (3 points) Briefly list three features that, in general, distinguish an ion channel from an ion transporter.

(5) (4 points) Write the base sequence of the RNA strand that is complimentary to a strand of DNA with sequence (5') AATCGCAGCTTGGACTTAG (3')

(6) (8 points) Shown below are two nitrogenous bases that you are familiar with. Write their names directly below them. Then, to the right of each base, draw the structure of its complimentary base in DNA, in the correct orientation to form a correct Watson-Crick base pair, and provide the name for the complimentary base. Once you have drawn the complimentary base, add the appropriate hydrogen bonds that form in the Watson-Crick base pair.

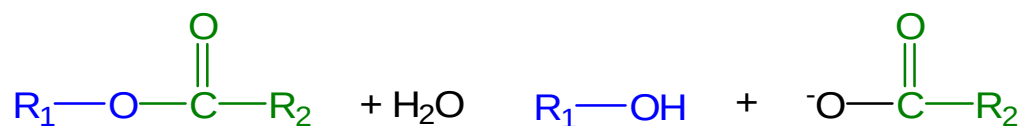


(7) (9 points) What types of membrane proteins are shown below? Identify them by letter. Suppose you wanted to solubilize these proteins from the membrane in a cell free lysate. Explain what conditions you would use to solubilize each protein, and briefly describe the biochemical basis for why that solubilization strategy would work.



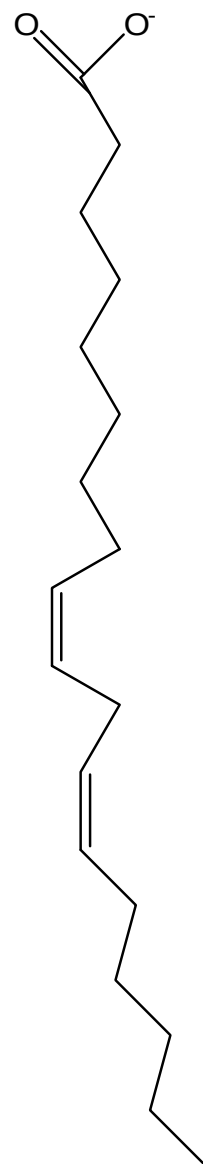
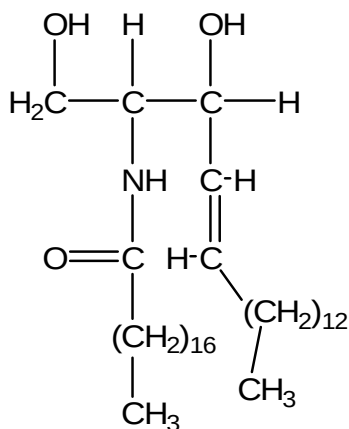
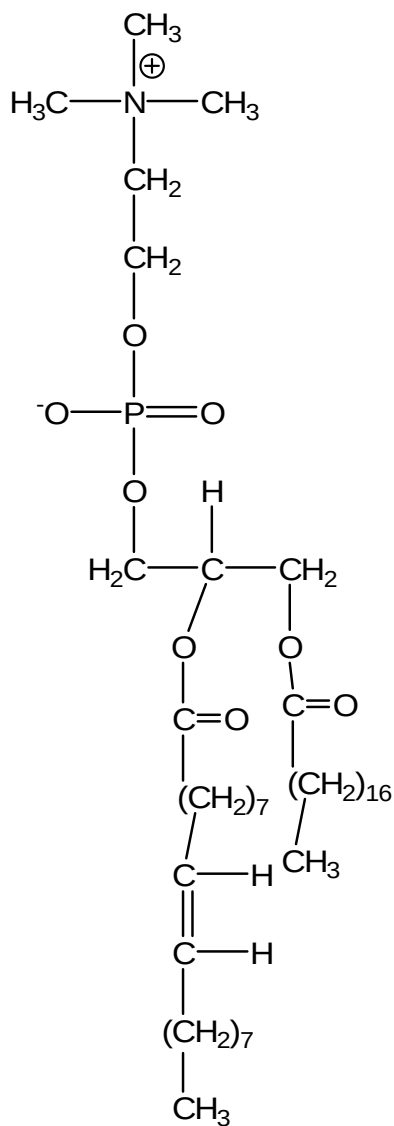
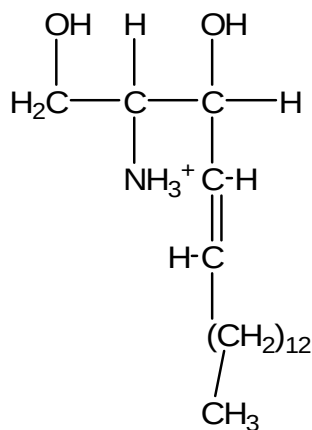
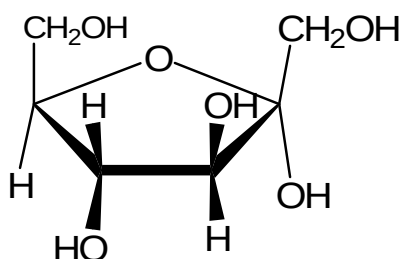
(8) (4 points) Name four amino acid residues that will have positive ΔG° hydrophobicity values.

(9) (10 points) Many hydrolases contain catalytic triads that play a role identical to that of the catalytic triad of chymotrypsin. Based on your knowledge of chymotrypsin-catalyzed amide bond hydrolysis, propose an analogous mechanism for the lipase-catalyzed hydrolysis of a triacylglycerol as shown below:

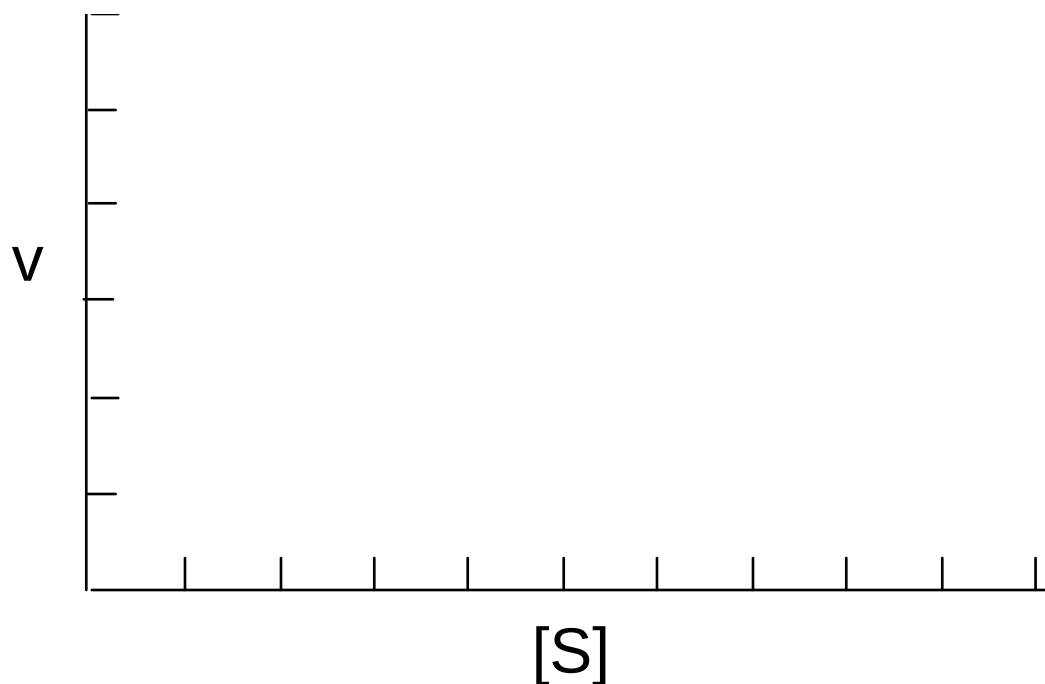


Please include all of the important features of chymotrypsin catalysis (covalent catalysis, catalytic triad, general acids/bases, oxyanion hole, etc) in your proposed mechanism. NOTE: you need not draw the complete structure of amino acid side chains--it is perfectly fine to abbreviate histidine, for example, as **His:** and **His-H⁺** for the purposes of this problem.

(10) (5 points) Provide proper names for each of the molecules shown below. Be sure each name is complete and unambiguous.



(11) (6 points.) You have a multimeric allosteric enzyme for which molecule “X” is a positive heterotropic modulator and molecule “Y” is a negative heterotropic modulator. Both modulators perturb $K_{1/2}$ but not $V_{\max}$. Draw and label the plots that would be observed for the enzyme in the absence of modulator, in the presence of “X”, and in the presence of “Y”. Label the positions of $V_{\max}$ and $K_{1/2}$ for each line.



12 (6 points) Draw the structures of D-altrose and alpha-D-altropyranose (draw BOTH the linear and cyclic forms), given that D-altrose is a C-3 epimer of D-mannose, and D-Mannose is a C-2 epimer of D-glucose