

Key

Biochemistry 5700

Fall, 2002

Exam 2

October 21, 2002

INSTRUCTIONS:

Do not begin until 10:30 AM. The exam must be turned in by 11:20 AM. This exam should have 10 questions and 7 pages. Please print your name at the top of each page of the exam. Answer **all** questions completely, concisely, and legibly in the spaces provided. **FEEL FREE TO USE DIAGRAMS/FIGURES, WHEN APPROPRIATE, IN ANSWERING QUESTIONS.** Good Luck!!

0 POINTS EXTRA CREDIT!!! ANSWER THESE WHILE WAITING TO START THE EXAM:

How much more sensitive (in %) are redheads to pain than normal, genetically inferior people?

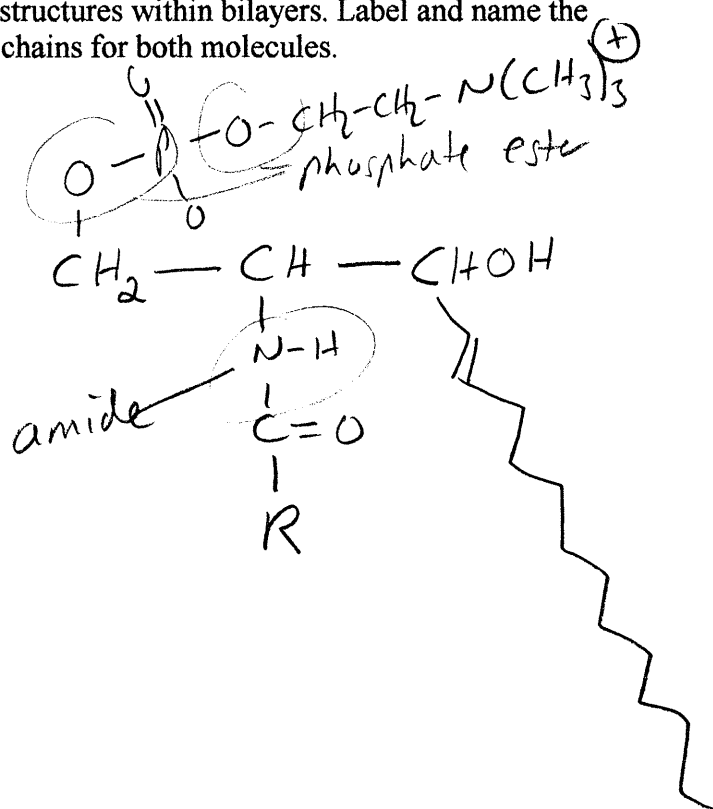
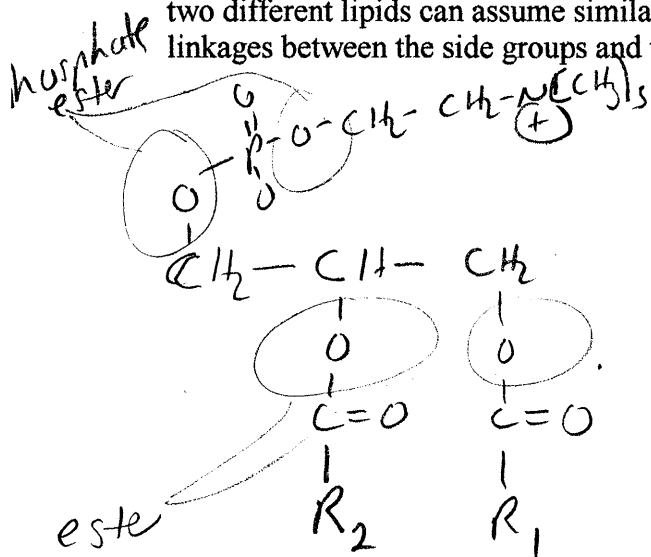
What two compounds are responsible for producing acrylamide in fried food?

What famous celebrity had a birthday yesterday?

(1) Definitions. 20 points.

Name the branched form of starch	amylopectin
When relatively high concentrations of glycerophospholipids are placed in water they form structures known as _____.	bilayers; liposomes
How many stereoisomers are possible for the family of D-aldoses with seven carbon atoms?	$2^{7-2} = 32$, (16) of which are "D"
Name the simplest carbohydrate that is a ketose	dihydroxyacetone
Linear sugars that are structurally identical except for the orientation of the hydroxyl and hydrogen at one position are called what?	epimers
The compound resulting from the nucleophilic addition of an alcohol to an aldehyde is called what?	hemiacetal
What type of bond joins two sugar units in a disaccharide?	O-glycosidic
What molecule is a membrane plasticizer?	cholesterol
What is the repeating sugar unit and linkage in chitin?	β 1,4 N-acetylglucamine
What is the repeating sugar unit and linkage in peptidoglycan?	β 1,4 NAM-NAG
Which nitrogenous base is present in DNA but not RNA?	thymine
What is the name of the family of derivatized polysaccharides that associate with proteins in the extracellular matrix of animal cell tissue	glycosaminoglycans
What types of sugar linkages are found in glycogen?	α 1,4 + α 1,6 branches
Ring-cyclized sugars that contain a free hydroxyl group at the anomeric carbon are called _____ sugars	reducing
Name the specific D-aldose in which ALL hydroxyl groups lie in the equatorial plain	β -D-glucopyranose
What vitamin is associated with vision?	A
What vitamin is associated with regulating calcium uptake for bone formation?	D
The relations $A = T$ and $G = C$ are called what?	Chargaff's rules
Name a general role for lipids other than serving as an energy reserve or structural component of membranes	hormones
What conformation does double stranded DNA form in solution?	B

(2) (10 points) Draw generalized structures (long chain hydrocarbons can be abbreviated) for phosphatidylcholine and sphingomyelin (containing choline) in orientations that highlight how the two different lipids can assume similar overall structures within bilayers. Label and name the linkages between the side groups and the main chains for both molecules.

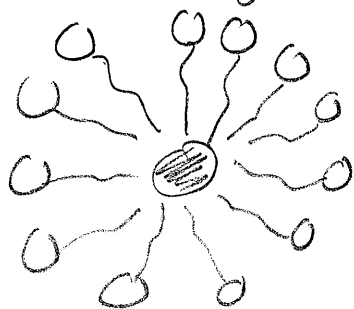


(3) (10 points)

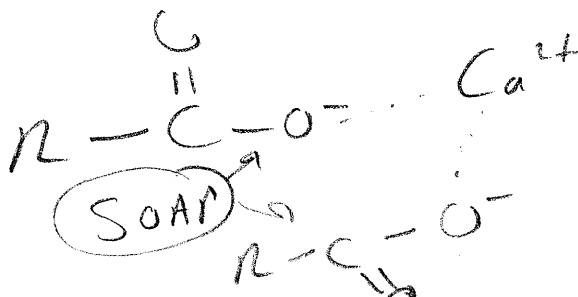
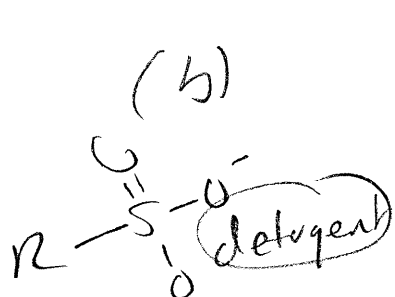
(a) Explain what soap is and the molecular basis for its ability to make you clean and fresh-smelling after a morning shower.

(b) Briefly explain why soap sometimes leaves a residue in the sink while synthetic detergents don't.

(a) K^+ salts of fatty acids + glycerol

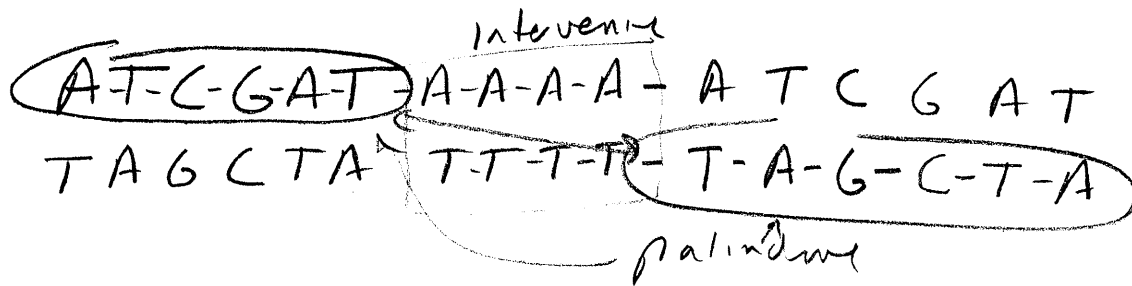


Fatty acid micelles trap hydrophobic dirt, oil & other molecules on your body.

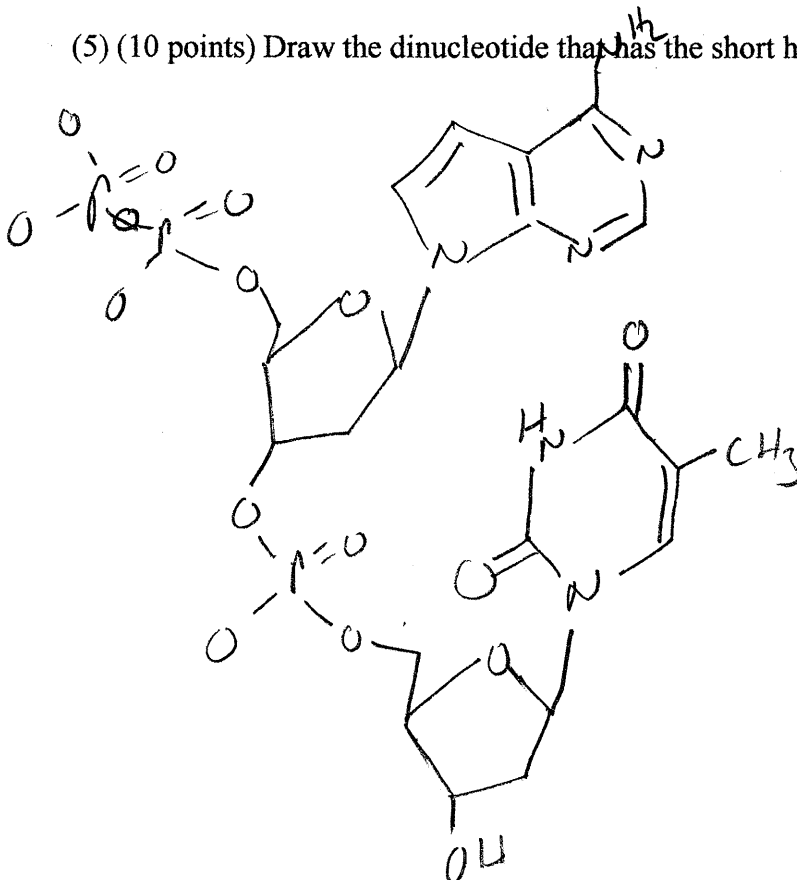


Ca^{2+} complexes of carboxylates are insoluble. Ca^{2+} complexes of sulfonates are soluble.

(4) (10 points) Write the base sequence for a double stranded DNA fragment [use short hand nomenclature (i.e. ATCG)-don't draw structures) that contains a six-nucleotide palindrome separated by four intervening bases.



(5) (10 points) Draw the dinucleotide that has the short hand abbreviation ppdApdT

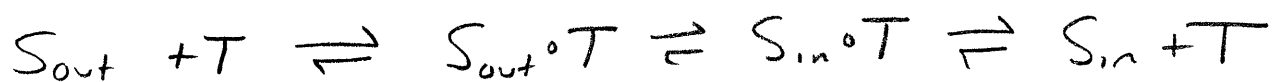


key

(6) (10 points) For each of the following, name a specific "transporter" representing that type, and name the molecule(s) transported:

Transport type	Name of transporter	molecule(s)
(a) passive uniport	glc permease	glucose
(b) passive antiport	Cl ⁻ bicarbonate exchange	Cl ⁻ HCO ₃ ⁻
(c) primary active transport: ATP driven	Na ⁺ , K ⁺ ATPase	Na ⁺ K ⁺
(d) primary active transport: light driven	bacteriorhodopsin	H ⁺
(e) secondary active transport	galactoside permease	lactose, H ⁺

(7) (5 points) Write the kinetic mechanism for a passive transporter (T) effecting the transformation
 Substrate_{outside cell} → Substrate_{inside cell}



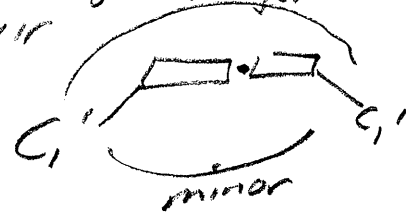
(8) (5 points) What are three features that, in general, distinguish an ion channel from an ion transporter?

- not saturable with S
- very high rates (diffusion limit)
- gated (rapid on/off regulation)

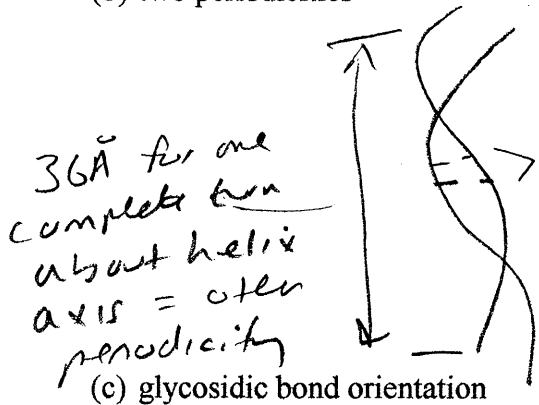
(9) 10 points. Briefly define the following terms as they relate to DNA structure:

(a) major groove

The side of DNA formed by the large angle connecting the $C1'$ carbons of paired bases & the center of the helix axis

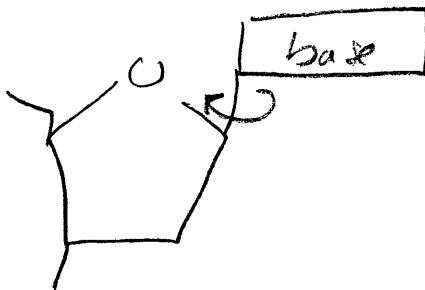


(b) two periodicities



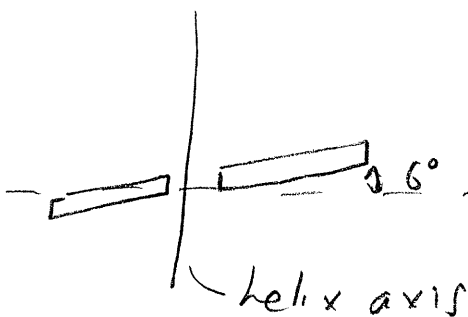
3.4 Å base pair - base pair distance - one periodicity

(c) glycosidic bond orientation



the orientation about the sugar base N-glycosidic bond angle is "anti" in B-DNA, with the base pointing away from the sugar

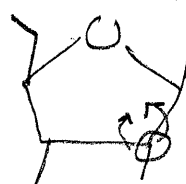
(d) base tilt



base pairs in double helix are tilted $\sim 6^\circ$ from $\perp$ plane to helix axis

(e) sugar pucker

for ribose & deoxyribose, 1 of 5 carbons lies out of plane of other 4:



$C2'$ on same side as $C5'$ = $C2'$ -endo

(10) 10 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.

