BCH 4053 **HOUR TEST 2** **NAME**_____
June 29, 2001

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(4) 1. In the Edman degradation of a protein, phenyl isothiocyanate is reacted with a peptide in _____(acid or alkaline?) conditions, and the _____(amino or carboxyl?) terminal aminoacid is cleaved in _____(acid or alkaline?) conditions and isolated and analyzed as a(n)_____(name) derivative.

(9) 2. Explain the role of each of the following reagents in sequencing a protein:

(a) cyanogen bromide

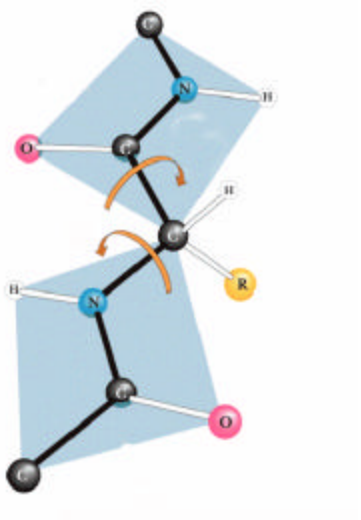
(b) fluorodinitrobenzene (Sanger reagent)

(c) performic acid

(6) 3.

(a) On the figure at the right, label the Φ (phi) and Ψ(psi) rotation angles.

(b) Draw a Ramachandran map below, label the axes properly, and indicate on the map the conformational location of (a) an alpha helix, (b) a beta sheet, and (c) collagen. Shade the quadrant of the map in which most Φ, Ψ angle combinations are found in proteins.



(13) 4. Given the following data on five different proteins:

Protein	M.W.($x10^{-3}$)	D	pI
fibrinogen	330	2.0	5.8
hemoglobin	64.5	6.9	7.0
lysozyme	14.4	11.2	11.0
ovalbumin	45.0	7.8	4.6
urease	483	3.5	5.0

Assume all proteins have partial specific volumes of about 0.73 ml/g. Indicate in the blanks the protein(s) with the indicated behavior.

_____ (a) Elutes first from a gel filtration column.

_____ (b) Elutes first from a DEAE column at pH 7.4. (i.e., an anion exchange column).

_____ (c) Elutes first from a carboxymethyl cellulose column at pH 4.8. (i.e., a cation exchange column).

_____ (d) Migrates fastest on electrophoresis in SDS.

_____ (e) Migrates to the cathode on electrophoresis at pH 6.0.

In general, the larger the molecular weight, the smaller the diffusion coefficient. However, note that urease has a larger molecular weight than fibrinogen, but also a larger D. What might account for this exception to the general trend?

(8) 5. Using the Haworth projection, draw the **structure** of:

(a) an **anomer** of β-D-galactose (b) an **enantiomer** of β-D ribose

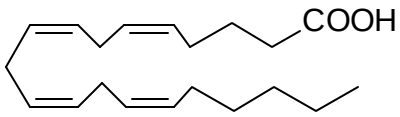
(c) the disaccharide found in milk. (d) the monosaccharide building block of **chitin**, the major structural polymer of insects.

(3) 6. Ribitol is a sugar alcohol formed by reducing the aldehyde group of ribose to an alcohol. What is the structural relationship between D-ribitol-5-phosphate and L-ribitol-1-phosphate?

(5) 7. Compare and contrast **starch** and **cellulose**, both plant polysaccharides, with respect to the following characteristics:

	Starch	**Cellulose**
monomer unit		
glycosidic linkage		
polymer shape		
function in plant		
digestibility by humans		

(16) 8. Complete the following table by supplying the missing information on each fatty acid. Be sure to show the double bonds in the correct *cis* or *trans* orientation.

Abbreviation.	**Common Name**	**Systematic Name**	**Structure**	**Omega designation**
9,12,15-$C_{18:3}$				
	linoleic acid			
	palmitoleic acid			
				

(3) 9. What is the difference between **cerebroside** and **ceramide**?

(6) 10. Mild base hydrolysis of phospholipids will cleave the fatty acid ester bond, but not the phosphodiester bonds. Give the structure of the glycerol derivatives formed by mild base hydrolysis of the following glycerophospholipids:

(a) phosphatidyl choline (b) phosphatidyl serine (c) phosphatidyl glycerol

(4) 11. Four types of lipid-linked anchors are known that attach proteins to membranes. Describe two of them, including the lipid involved and the manner in which the lipid is attached to the protein.

(3) 12. What structural feature distinguishes **gangliosides** from other glycosphingolipids?

(4) 13. Give two experimental features that would distinguish between passive diffusion and facilitated diffusion in the transport of a substance across a cell membrane.

(6) 14. What is the difference between **antiport** and **symport**? Give an example of each from the transport systems we have studied.

(4) 15. Potassium ions can be transported across a phosphatidylcholine bilayer by the antibiotics valinomycin and gramicidin. The rate of transport by valinomycin greatly decreases when the temperature is lowered from 25°C to 15°C, but the rate of transport by gramicidin is little affected by this temperature change. Explain this result in terms of the structure of the bilayer membrane and the mode of action of the two antibiotics.

(6) 16. Phospholipid vesicles containing no potassium ions are placed in a solution containing 200 mM potassium at a temperature of 25°C. Valinomycin is added and the system is allowed to come to equilibrium at which point it was determined that the external potassium concentration had dropped to 195 mM and the potassium concentration inside the vesicles was 25 mM. What do you expect the electrical potential ($\Delta\Psi$) to be across the vesicle membrane? Which side of the membrane will be more positive?
(R = 8.315 J/mol-K; F = 96.5 kJ/volt-mol)