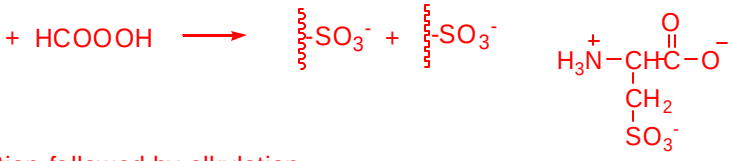
BCH 4053 **HOUR TEST 2** **NAME_____KEY_____**
February 28, 2003

Page	Points
1	22
2	30
3	25
4	23
Total	100

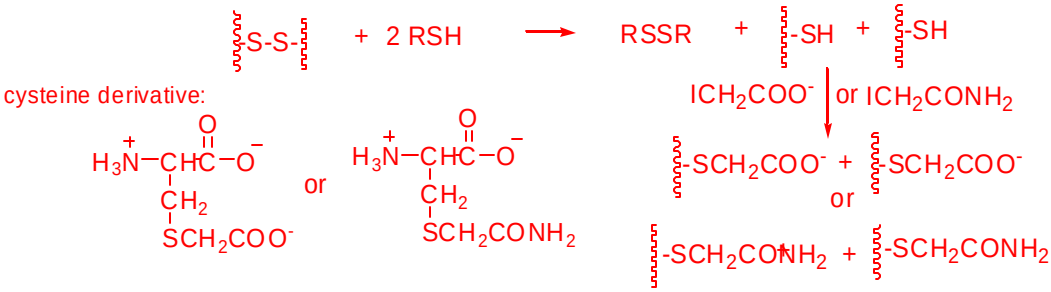
(10) 1. Describe two methods of cleaving disulfide bonds prior to sequencing a protein, indicating the reagents used in each case and the structure of the cysteine residue produced after the cleavage.

1 pt rxn, 2 pts reagent(s), 2 pts cysteine derivative structure

(a) Performic acid oxidation



(b) Reduction followed by alkylation



(6) 2. A peptide was subjected to the following degradative techniques resulting in the fragments with the indicated sequences.

I. Cyanogen bromide treatment

Asp-Ile-Lys-Gln-Met
Lys-Val-Ser
Lys-Phe-Ala-Met
Tyr-Arg-Gly-Met

II. Trypsin hydrolysis

Gln-Met-Lys
Gly-Met-Asp-Ile-Lys
Phe-Ala-Met-Lys
Tyr-Arg
Val-Ser

Give the complete sequence of the original peptide.

Tyr-Arg-Gly-Met-Asp-Ile-Lys-Gln-Met-Lys-Phe-Ala-Met-Lys-Val-Ser

6 pts complete sequence, 3 pts if all but one peptide aligned properly, 0 pts if more than one missed

(6) 3. Fill in the following blanks with **a helix** or **disordered** to represent the primary conformation of the indicated synthetic polypeptide at the indicated pH.

1 pt each

Polypeptide	**pH 2**	**pH 7**	**pH 12**
polyglutamate	**a helix**	**disordered**	**disordered**
polylysine	**disordered**	**disordered**	**a helix**

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

Protein	M.W	D	pI
cytochrome c	13,400	11.4	10.6
fibrinogen	330,000	2.0	5.6
serum albumin	65,000	5.9	4.8
ovalbumin	45,000	7.8	4.6

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

3 pts each blank

___serum albumin_____ (a) Elutes **second** from a gel filtration column.

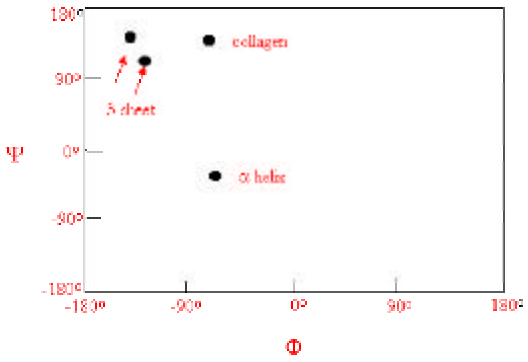
___cytochrome c_____ (b) Does not bind to a DEAE column at pH 7.4. (i.e., an anion exchange column).

serum albumin and ovalbumin (c) Does not bind to a carboxymethyl cellulose column at pH 5.0. (i.e., a cation exchange column).

___cytochrome c_____ (d) Migrates fastest on electrophoresis in SDS.

(6) 5. Draw a Ramachandran map, label the axes properly, and indicate on the map the conformational location of (a) an alpha helix, (b) a beta sheet, (c) collagen.

2 pts each

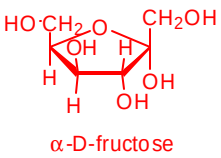


(12) 6. Using the Haworth projection, draw the **structure** of:

(a) an **anomer** of β-D-fructose (b) an **epimer** of β-D glucose

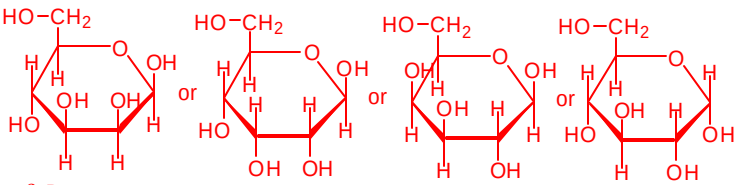
3 pts each, names not necessary

(a)



α-D-fructose

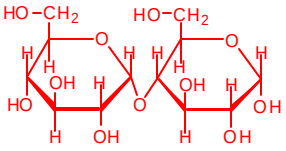
(b)



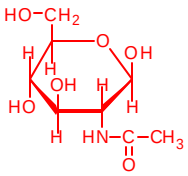
(c) maltose.

(d) the monosaccharide building block of **chitin**, the major structural polymer of insects.

(c)



(d)

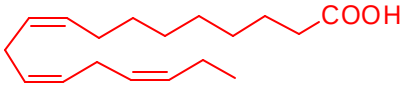
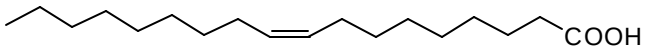
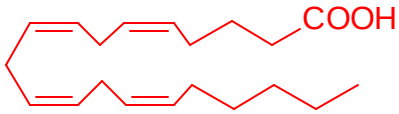


(3) 7. What is the structural relationship between L-glycerol-3-phosphate and D-glycerol-1-phosphate?

The same compound

(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.

1 pt each

Abbreviation.	**Common Name**	**Systematic Name**	**Structure**	**Omega designation**
9,12 -$C_{18:2}$	linoleic acid	9,12-octadecadienoic acid		ω-6
9,12,15-$C_{18:3}$	a-linolenic acid	9,12,15-octadeca-trienoic acid		ω-3
9-$C_{18:1}$	oleic acid	9 octa-decenoic acid		ω-9
5,8,11,14-$C_{20:4}$	arachidonic acid	5,8,11,14-eicosatetraenoic acid		ω-6

(6) 9. Phosphatidyl ethanolamine and lysophosphatidyl ethanolamine form different types of aggregate structures. Describe the different structures (words or diagram), and explain what structural difference between the two lipid molecules accounts for this difference.

2 pts each:

PE forms bilayer structures (or lamellar sheet structures)
lysoPE forms spherical micelles
PE has two hydrocarbon chains per molecule, lysoPE has only one.

(Okay if bilayer and spherical micelle structure are drawn)

(8) 10. **Circle** the following lipids which are negatively charged at pH 6, and **underline** those that contain a nitrogen atom.

0.5 pts each mark on each structure

phosphatidyl choline	phosphatidyl serine
phosphatidyl glycerol	cholesterol
sphingomyelin	palmitic acid
phosphatidic acid	phosphatidyl inositol

(9) 11. Distinguish between integral and peripheral membrane proteins in terms of

(a) types of solutions used to extract them from membranes.

3 pts each part, 1.5 each subpart

integral—organic solvents and detergents
peripheral—high salt, chelating agents, mild detergents

(b) forces by which they are attached to membranes.

integral—hydrophobic attachment to hydrocarbon center of lipid bilayer
peripheral—ionic, polar, and hydrogen bonding

(c) membrane location in the fluid mosaic model.

integral—imbedded in or through the lipid bilayer
peripheral—attached to surface at lipid head groups or surface of integral proteins

(6) 12. 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.

Any 2, 3 pts each

N-myristoylation: amide linkage to N-terminal glycine

fatty acyl thioester: several fatty acids (myristate, palmitate, stearate, oleate) linked to cysteine SH

polyprenyl thioether: farnesyl or geranylgeranyl ether to cysteine SH (Cys carboxy is methylated)

phosphatidyl inositol: glycosyl linkage between inositol and oligosaccharides, which is connected through ethanolamine to carboxyl terminal group of protein