

Name _____

Score _____

Exam 2, BICH 440, October 23, 2006

You MUST sign the following academic integrity statement:

On my honor, as an Aggie, I have neither given nor received unauthorized aid on this academic work. Signed: _____

Write concise answers to demonstrate effectively your mastery of the subject. Show your work in order to receive maximum credit where applicable.

gas constant R 8.315 J/mol-K

Faraday constant F 96.5 kJ/mol-volt

1) (8 pts) How many different disaccharides of D-glucopyranose are possible? List the possibilities (but DO NOT draw the structures of each possibility).

2) (6 pts) Given the following double-stranded fragment of DNA:

5'- ACTTGGCAGGCCTTCGATCC-3'

3'- TGAACCGTCCGGAAGCTAGG-5'

A hypothetical restriction endonuclease recognizes a 6bp sequence with two-fold symmetry (typical for restriction enzymes) found in this fragment and catalyzes cleavage of this DNA on both strands between GG nucleotides within the recognition sequence. This nuclease exhibits b-type cleavage (atypical for restriction enzymes). Draw the double-stranded sequence of each fragment after cleavage showing any phosphates left on the ends.

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3) (9 pts) Draw the structure of cholesterol at pH7 (ignore stereochemistry).

4) (15 pts) Draw the structures of the following two nucleosides in a standard Watson-Crick base-pair (the "normal" base-pair) (pH 7). Depict hydrogen bonds by dotted lines.

A) 3'-deoxyriboadenosine (adenine is attached by a beta-glycosidic linkage to 3-deoxyribose)

B) 2'-N-acetylribouridine (uracil is attached by a beta-glycosidic linkage to 2-N-acetylribose)

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5) (12 pts) Draw the structure of phosphatidylcholine that contains an 18:0 fatty acid and an 18:2(9,12) fatty acid in their preferred positions (pH7).

6) (10 pts) From the list of peptides below, match the BEST choice with each statement. A peptide can be used for more than one answer.

- A. GPPG
- B. VISA
- C. QGPC
- D. ALVL
- E. NAVY

___ could be a segment of an N-glycosylated protein

___ could be a segment of a collagen protein

___ most likely possibility above that is in a transmembrane segment of an integral membrane protein

___ could be a segment of a lipid-linked protein with an isoprene anchor

___ could be a segment of an O-glycosylated protein

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7) (15 pts) Calculate the maximum ratio of $[\text{galactose}]_{\text{inside}} : [\text{galactose}]_{\text{outside}}$ that can be driven by the symport of Na^+ in a secondary active transport process. The ratio of $[\text{Na}^+]$ inside the cell to $[\text{Na}^+]$ outside the cell is 0.05, and the membrane potential is -60 mV , with the outside being more positive than the inside. Use a temperature of 37C for your calculations.

8) (25 pts) Shorter answer questions.

- A) (5 pts) Explain what is meant by conformational entropy regarding the thermodynamics of protein folding. Does this factor contribute towards a negative or positive free energy change in the direction of a folded protein?
- B) (2 pts) What type of “supersecondary” structure is repeated in a beta barrel exemplified by triosephosphate isomerase (TIM barrel)?
- C) (2 pts) What type of secondary structure predominates in silk fibroin?
- D) (2 pts) Name an epimer of D-glucose.
- E) (2 pts) What is the chemical difference between the carbohydrate polymers cellulose and amylose?
- F) (3 pts) Approximately how many amino acids exist in a transmembrane alpha helix that traverses the lipid bilayer at a right angle? (You do NOT need to show a calculation, but if you cannot remember, then the calculation will be necessary.)
- G) (3 pts) Approximately how many nucleotides in a single-stranded DNA oligonucleotide with molecular weight of 20,000?

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H) (4 pts) The sodium-potassium pump transports what ions, in what direction across the plasma membrane, and in what relative stoichiometry?

I) (2 pts) What wavelength is commonly used to determine the concentration of nucleotides or nucleic acids by spectrophotometry?