

UID# \_\_\_\_\_

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Score printed on next page

**BICH 440, EXAM 2, Wednesday, October 22, 2008, 100 points total**

You MUST sign the following academic integrity statement:

On my honor, I have neither given nor received unauthorized aid on this academic work.

Signed: \_\_\_\_\_

1. Write your name and UID# on the cover page ONLY.
2. Write your student UID# on page 2 (at least). If you do not remember your UID#, make up a random 8 digit number. DO NOT use your social security number.
3. Write concise answers to demonstrate effectively your mastery of the subject. In order to obtain maximum credit, you need to show your work.

gas constant            R 8.315 J/mol-K  
Faraday constant      F 96.5 kJ/mole-volt

Exam 2 Score \_\_\_\_\_

UID# \_\_\_\_\_

1.(9 pts) Draw the structure of cholesterol at pH7.

2.(10 pts) Draw the structure of the disaccharide containing D-glucuronate in a beta(1 → 3) linkage to N-acetyl glucosamine (reducing end in beta configuration) at pH7. Each monosaccharide is in the pyranose form. Hint: glucuronate is glucose that has been fully oxidized at carbon-6.

3.(13 pts) A plasmid DNA contains 5000 base-pairs (normal B-form DNA). Starting with the relaxed form of the plasmid DNA, it is then treated with DNA gyrase to introduce 10 negative supercoils. Answer the following questions.

- A) What are the linking numbers for the DNA both before and after treatment with DNA gyrase?
- B) What is the superhelical density after treatment with the enzyme?
- C) What is the approximate molecular weight for this plasmid DNA?

4.(12 pts) Draw the structures of the nucleoside, 2'-deoxyguanosine, and the nucleotide, 5'-CMP, when the bases are engaged in a standard Watson-Crick style base-pair. Draw the base/sugar conformations in anti. The pH is 7.

5.(15 pts) Imagine there is a  $\text{Na}^+$  membrane transporter protein in muscle that uses a sodium gradient to couple the synthesis of creatine phosphate (CP) from creatine and phosphate. Suppose that the intracellular (inside) concentrations are:  $[\text{creatine}] = 1\text{mM}$ ,  $[\text{phosphate}] = 5\text{mM}$ ,  $[\text{creatine phosphate}] = 2\text{mM}$ ,  $[\text{Na}^+] = 15\text{mM}$ , and the membrane potential is  $-80\text{ mV}$  (inside more negative). Also, the standard free energy change for CP hydrolysis is  $-43.3\text{ kJ/mole}$ , and the temperature is  $37^\circ\text{C}$ .

- A) Calculate the extracellular concentration of  $\text{Na}^+$  required to synthesize CP. Assume a stoichiometry of one sodium ion transported per molecule of CP synthesized.
- B) Do you think the existence of this transporter is reasonable based on your thermodynamic calculation?

6)(12 pts) Draw the structures of the cleavage products of phosphatidyl choline (a glycerophospholipid or phosphoglyceride) containing 18:0 and 18:2 $\Delta$ 9,12 fatty acids AFTER hydrolysis catalyzed by phospholipase A<sub>2</sub>. Place the fatty acids in their preferred locations on the molecule, and depict double bonds in their typical configurations. Assume pH 7.

7)(6 pts) Which double-stranded DNA in each pair has the highest melting temperature and WHY? Circle your answer.

A) 200 bp repeating sequence of A-T on each strand vs. 500 bp with 50% G+C composition

B) 100 bp with 30% G+C composition vs. 100 bp with 70% A+T in 50% formamide

C) 20 bp with 50% G+C composition vs. 100 bp with 50% G+C composition

8)(23 pts) Shorter answer:

A)(2 pts) Draw the structure of dihydroxyacetone

B)(2 pts) Using the Greek letter terminology, what is the quaternary structure of an IgG molecule?

C)(4 pts) Draw the structure of palmitic acid (16:0) covalently attached to the appropriate amino acid sidechain in a lipid-anchored membrane protein.

D)(2 pts) Name an example of a primary active transporter protein that is “powered” by absorption of light.

E)(2 pts) What is meant by secondary structure in RNA?

F)(2 pts) Name one example of an intercalating agent.

G)(2 pts) What is the name of the famous biochemist who formulated the rules that the amounts of A and T are equal, and the amounts of G and C are equal in DNA?

H)(3 pts) Name three common and easy treatments used to denature proteins.

I)(2 pts) Draw the structure of D-ribitol (ribose that is reduced at the aldehyde group).

J)(2 pts) What specific feature of RNA structure is responsible for its susceptibility to alkaline hydrolysis?