Mol Bio Biochem 694:407 &115: 511 Name_____
Second Hourly, Deis
Tuesday, Oct. 31, 2006 Row Letter ____ Seat Number ____

This exam consists of two parts. Part I is multiple choice. Each of these 25 questions is worth two points. Answer the Part I questions on this sheet, below. Answer the Part II questions on the question pages.

Please use BLOCK CAPITAL letters like this --- A, B, C, D, E. Not lowercase!

1. C
2. C
3. C
4. C
5. C
6. F
7. B
8. E
9. B
10. D
11. D
12. C
13. C
14. A
15. C
16. C
17. D
18. B
19. A
20. C
21. B
22. D
23. A
24. D
25. ww

GRADE:

Part I Total _____

Part II:

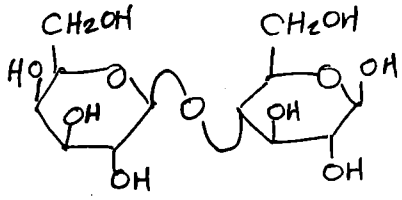
II-1 _____
II-2 _____
II-3 _____
II-4 _____
II-5 _____

Part II Total _____

Total, I & II _____

1. D-Glucose and D-Allose have what relationship with each other?
   - A. anomers
   - B. 2-epimers
   - C. 3-epimers
   - D. 4-epimers
   - E. enantiomers

2.* The disaccharide drawn at right is



   - A. Sucrose
   - B. Maltose
   - C. Lactose
   - D. Cellobiose
   - E. Trehalose

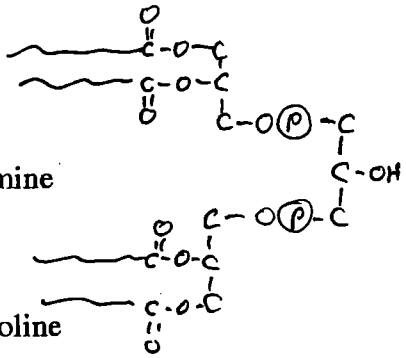
3. A person with a deficiency of the enzyme Lactase is said to have
   - A. galactosemia
   - B. lactation
   - C. lactose intolerance
   - D. lachrymosis
   - E. none of the above

4. Both prokaryotic and eukaryotic cells tend to have glycolipids where?
   - A. on the nuclear membrane
   - B. inside surface of outer membrane
   - C. outside surface of outer membrane
   - D. outer mitochondrial membrane
   - E. all of the above

5. In organs, cells are generally connected
   - A. by linking membranes
   - B. many cells join to make one big cell
   - C. integrins link cytoskeleton to common extracellular matrix
   - D. cells just coexist side by side

6. A common fatty acid is Oleic Acid, which has the structure
   - A. 18:0
   - B. 18:1 Δ7
   - C. 18:3 Δ9, 12, 15
   - D. 18:2, Δ6, 9
   - E. 18:2, Δ9, 12
   - F. 18:1, Δ9

7.* Which lipid is represented here?



   - A. Lecithin
   - B. Cardiolipin
   - C. Phosphatidyl Serine
   - D. Phosphatidyl Ethanolamine

8. Sphingomyelin contains sphingosine plus what?
   - A. fatty acid, sugar
   - B. fatty acid, phosphate, sugar
   - C. 2 fatty acids, phosphate, choline
   - D. only sugar
   - E. fatty acid, P_i, choline

9. Triglycerides with three of the same fatty acid are named Tri- plus the name of the fatty acid, e.g. Tristearate. Which of the following TG would have the highest melting point (and would be considered a "fat")?
   - A. Trilinolenate
   - B. Tristearate
   - C. Trioleate
   - D. Trilinoleate

18. In the mechanism of Aldolase, the substrate binds covalently to a residue of what amino acid on the enzyme?

A. Ser
B. Lys
C. AsN
D. Cys
E. Ala

19. Which Glycolysis enzyme has an unusually high positive standard free energy change (in the "forward" direction of Glycolysis)?

A. Aldolase
B. Hexokinase
C. Fructonase
D. UDP Gal Epimerase
E. PG Kinase

20. How many helical turns are there in a fragment of B DNA that is 1000 base pairs long?

A. 10
B. 50
C. 100
D. 500
E. 1000

21. The nucleoside composed of "C" plus ribose would be called:

A. Cytosine
B. Cytidine
C. Cytherine
D. Cytidylic Acid
E. Cytosidine

22. In normal Watson-Crick base pairing, C pairs with

A. A
B. U
C. C
D. G
E. T
F. F

23. The difference between the A and B form DNA is caused by:

A. Differences in sugar pucker.
B. Differences in pairing between the bases.
C. Repulsion of phosphates.
D. Differences in the conformation of the N-C glycosidic bonds.

24. Bases can rotate about the glycosidic bond to deoxyribose in DNA. Pyrimidines are nearly always confined to which conformation?

A. axial
B. equatorial
C. syn
D. anti
E. cis
F. trans

25. Pick a winner (two free points)

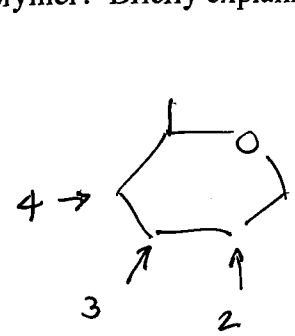
A. Yankees
B. Cardinals
C. Mets
D. Tigers
E. Red Sox

 Name _____

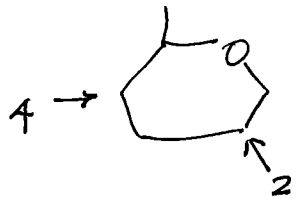
Answer these questions here on the question pages.

1. a. A polymer of glucose is isolated from dental plaque bacteria and methylated using methyl iodide. Then all glycosidic bonds are hydrolyzed using aqueous acid. The major products are found to be 2,4 Di-O-methyl glucose and 2,3,4 Tri-O-methylglucose. What can you deduce about the structure of this polymer? Briefly explain your logic.

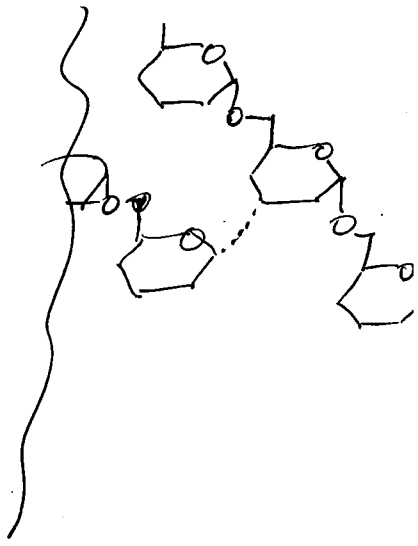
(4)



So normal linkage is 1→6 (S is "busy" as the ring linkage)



So "branch" points are at 3

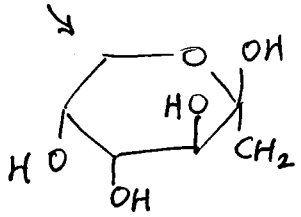


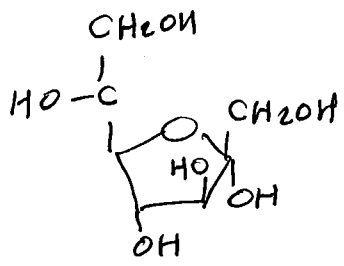
b. Dental plaque bacteria never use the familiar α-1,4 linkage found in starch and glycogen. Why not?

(2) Saliva has α amylase and the plaque would be digested

c. The fructose found in honey is in the form β-D-fructopyranose, one of the sweetest sugars known. Draw β-D-fructopyranose, and then draw α-D-sedoheptulofuranose.

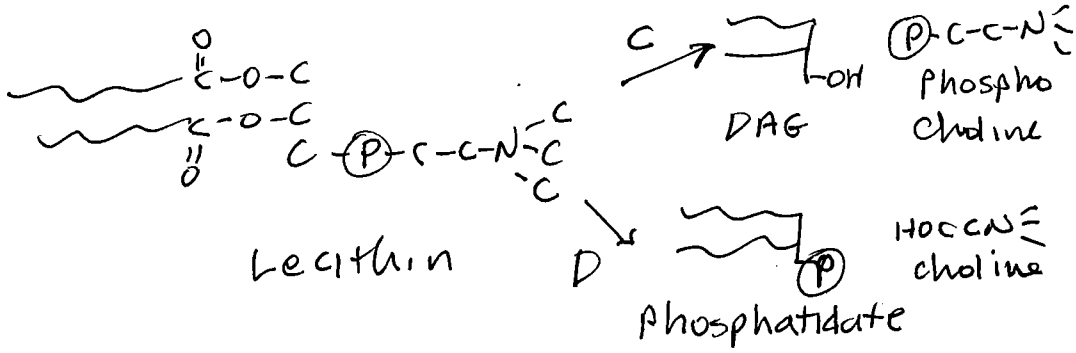
(4) NOTHING HERE





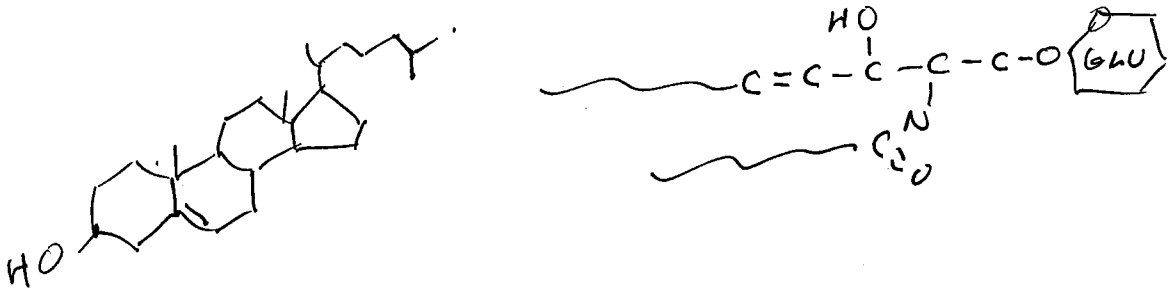
2. a. Lecithin is phosphatidyl choline. Draw it (squiggly lines are OK for fatty acids) and show two separate reactions – Lecithin reacting with Phospholipase C, and Lecithin reacting with Phospholipase D. In each case draw and name the products.

(4)



b. Draw cholesterol and glucosyl cerebroside. Sugar can be represented by a hexagon, but draw out the rest of the structure.

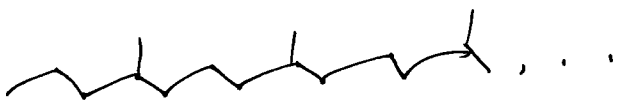
(3)



c. Describe how archaeal lipids differ from the membrane lipids of bacteria and eukaryotes. Give as many specifics as you can. How/why is the special structure of archaeal lipids beneficial to them?

(3)

not fatty acids but isoprenoid chains
sometimes "monolayer"
ether link to glycerol not ester
methyl branchy Phytol or Diphytyl



Archaeal Lipids are "tough" in high temperatures, strong acid, etc.

3. a. Given the following Standard Reduction Half Reaction Potentials:

Cytochrome c (Fe^{3+}) + e^-	→ cytochrome c (Fe^{2+})	1e-	+0.254 V
$NAD^+ + H^+ + 2e^-$	→ NADH	2e-	–0.320 V

Calculate the standard potential difference and standard free energy change when two electons are transferred from NADH to Cytochrome c. F = 96.5 kJ/V mol, R = 8.3 J/mol K and T = 300K.

(4)

+,320
+.254
.574

$\Delta E_o' = +0.574\ V$

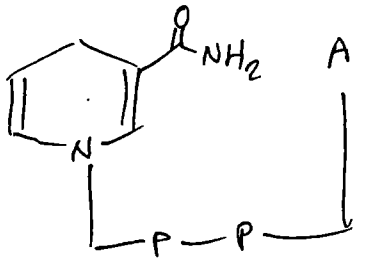
$\Delta G^{o'} = -n\,\mathcal{F}\,\Delta E_o'$

$= (-2)(96.5)(0.574)$

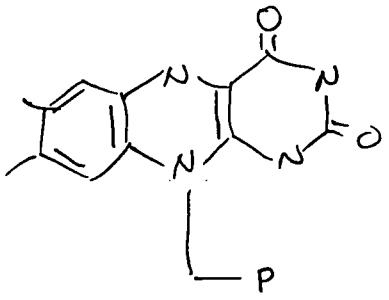
$= -111\ kJ/mol$

b. Identify the cofactors drawn below:

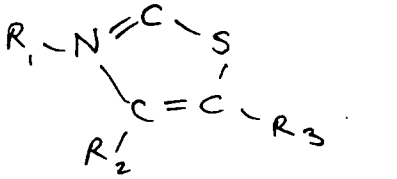
(6)



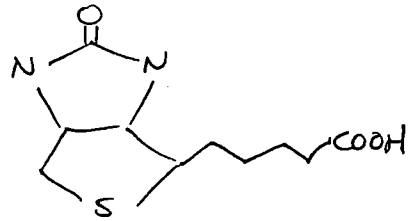
NADH



FMNH2



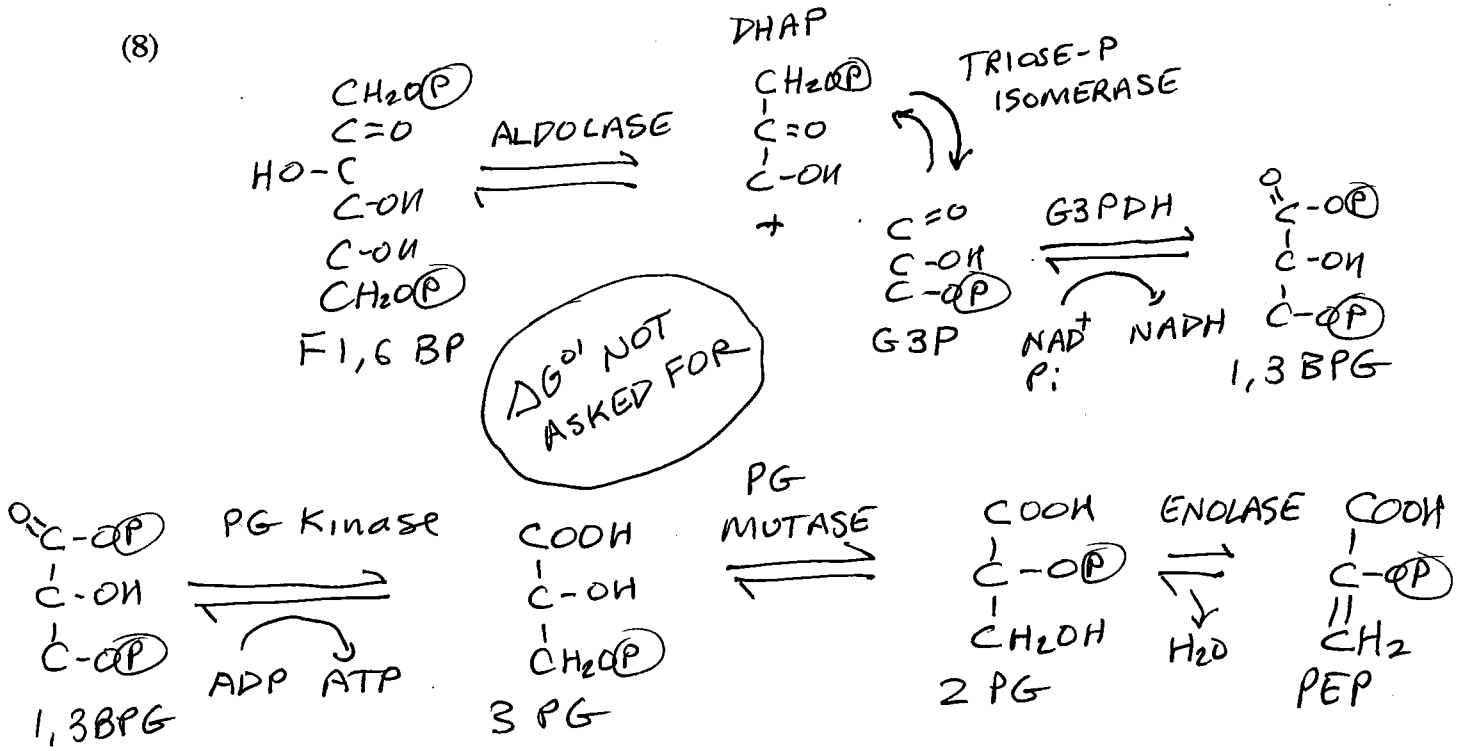
THIAMINE



BIOTIN

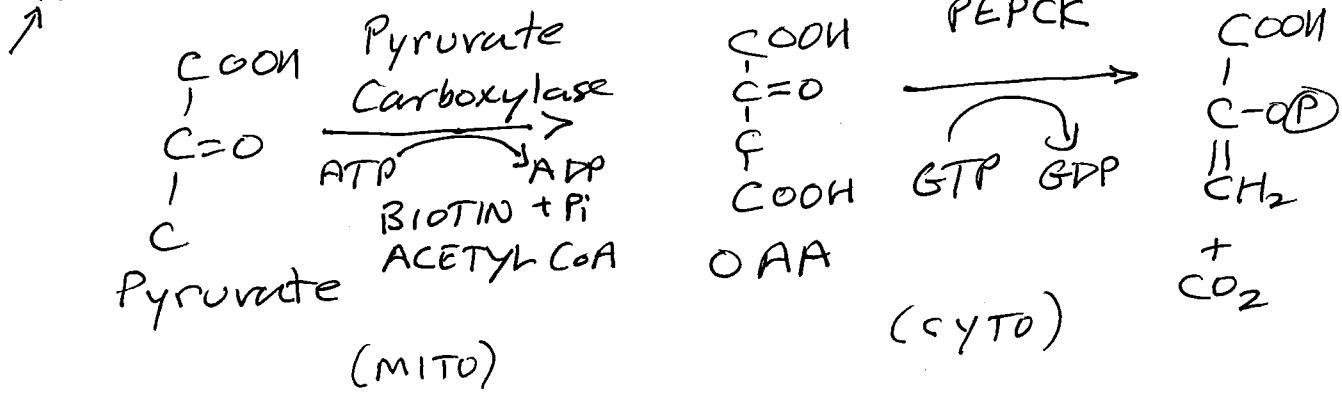
4. a. Show how Glycolysis would convert Fructose-1,6-bisphosphate into PEP. Draw all reactants and products, name all enzymes, and indicate all cofactors. You do not need to show mechanisms. One half point per fact. If you need to use the back be sure to say "see back."

(8)



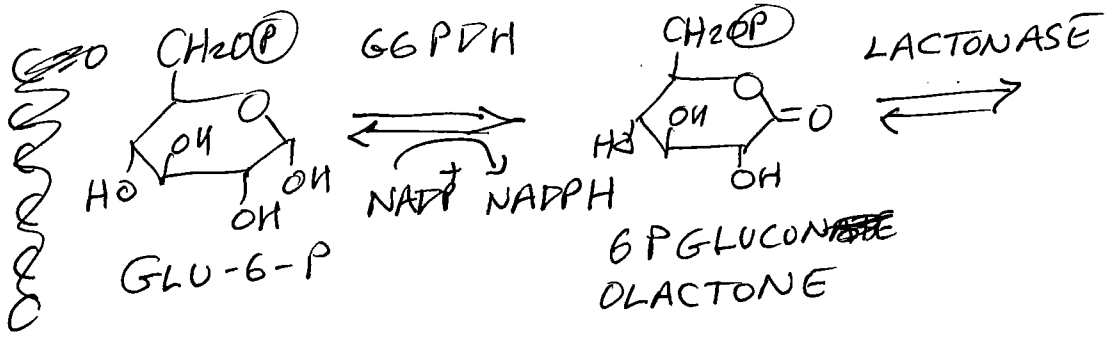
b. Show how Gluconeogenesis would convert Pyruvate into PEP. Draw reactants and products, name enzymes, indicate cofactors. You can omit Malate and compartments.

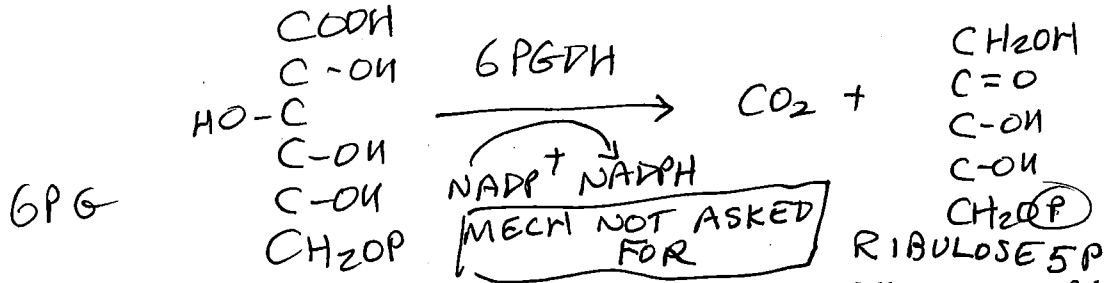
(2)



5. a. Show the Oxidative Branch of the Pentose Phosphate Pathway, from Glucose-6-P to Ribose-5-P. Draw all reactants and products, name enzymes, indicate cofactors. About 1/2 point per fact.

(5)





b. Draw a complete GC base pair – include full structures of bases and sugars, and show hydrogen bonds. Show major and minor grooves. Indicate whether the base is in syn or anti conformation with respect to the sugar, and mark with an arrow the 5' to 3' directionality of the chain for each nucleotide. To clarify – are the chains going in the same direction or opposite?

(5)