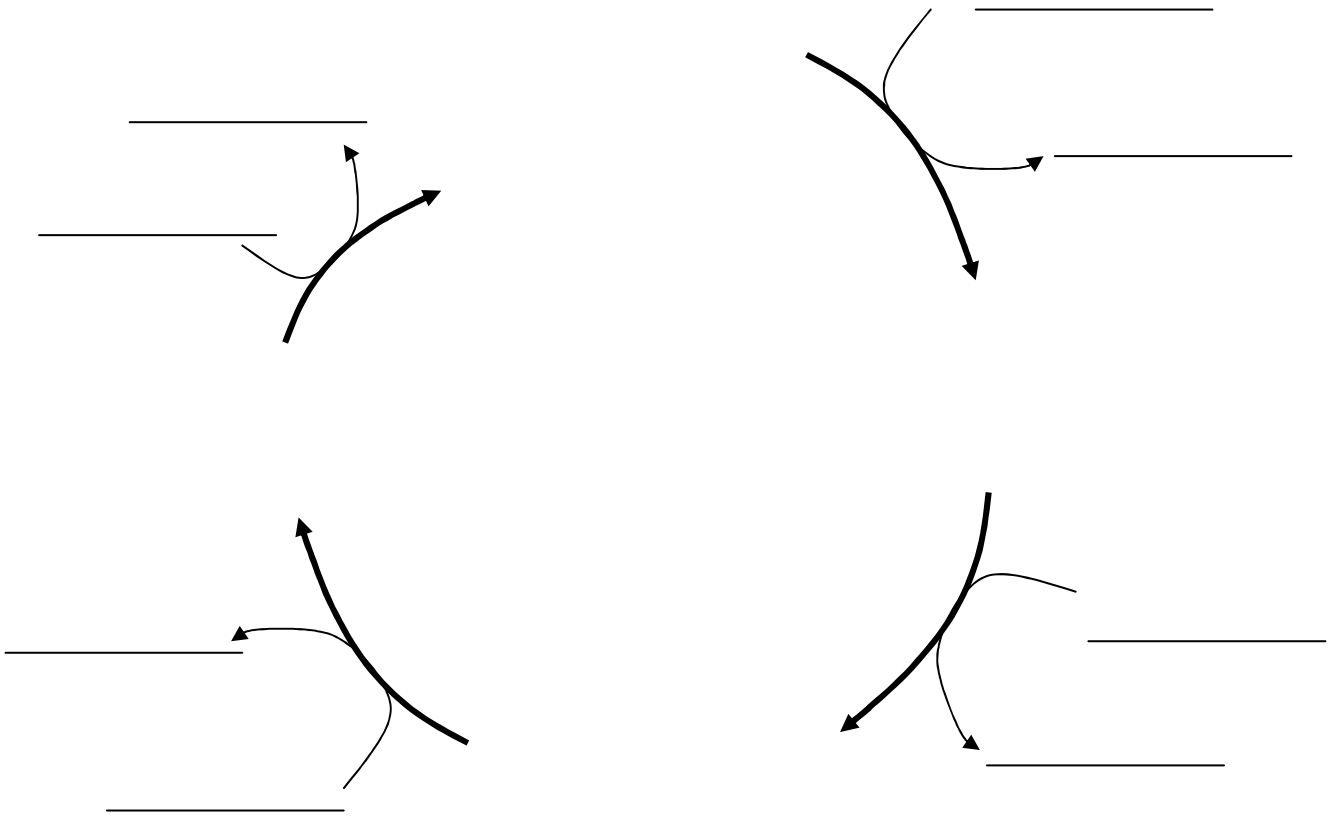
Name _____

MMBB 380 - Fall 2005
EXAM 5 –Photosynthesis, Lipids & Nucleic Acids

Please read each question carefully. You will not use a calculator for this exam.
Good luck and enjoy the upcoming break from classes!

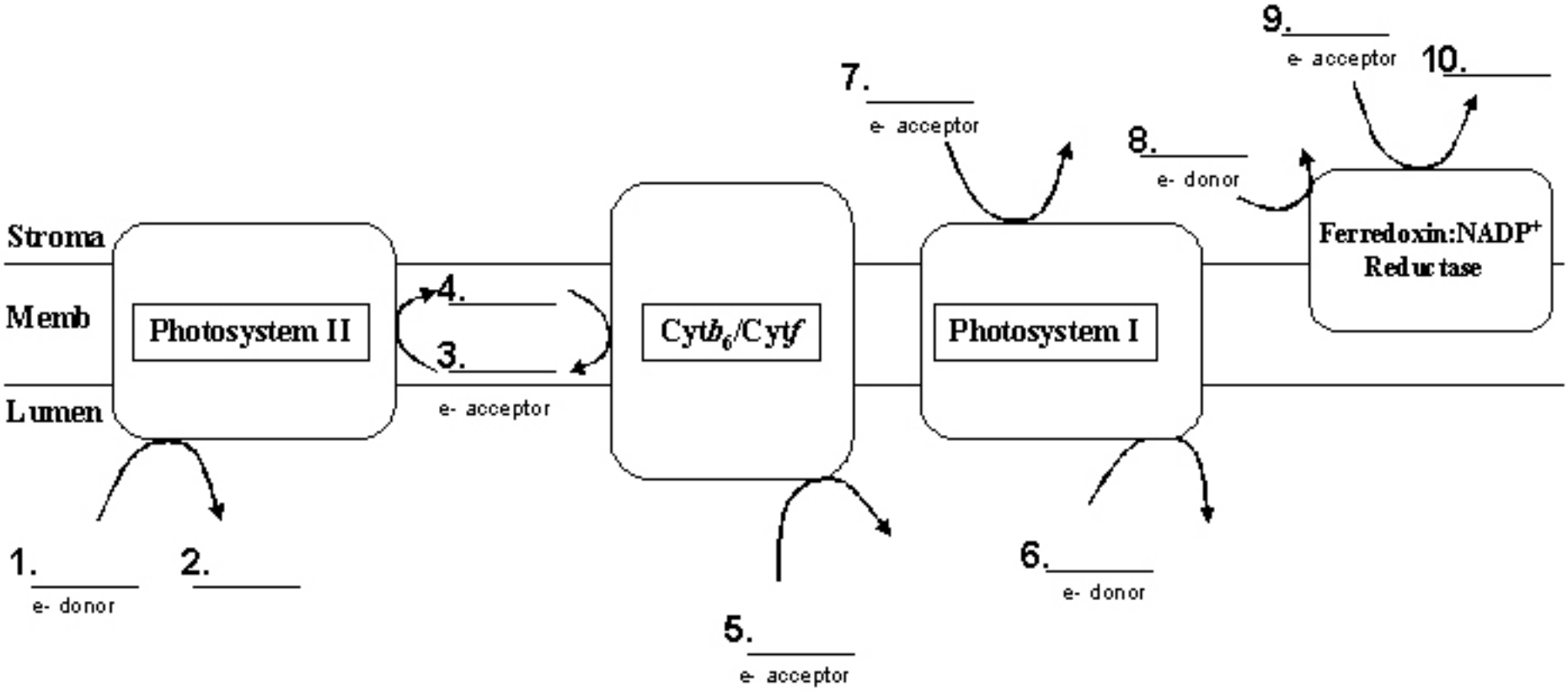
(32,000 pts)

1) Please illustrate one cycle of β-oxidation (breakdown) of a fatty acid. You do not have to name the enzymes involved nor the intermediates. Include the consumption and generation of all small molecules on the horizontal lines provided (note that one or more of these lines should be left blank).



(20,000 pts)

2) The following diagram represents a significant portion of the higher plant photosynthetic machinery as described in class. Fill in the ten blanks; this will include molecules that donate or accept electrons (some of these are indicated) . Be sure to indicate the oxidation state of the acceptors and donators.



(6,000 pts)

3) In what order do the following five steps occur in photosystem II?

1) **Passage of an electron from H_2O to the reaction center chlorophyll**
2) **Light excitation of antenna chlorophyll molecule**
3) **Excitation of the chlorophyll *a* molecule at the reaction center**
4) **Quantum transfer of energy from an antenna chlorophyll to a neighboring chlorophyll**
5) **Passage of an excited electron from the reaction center to another molecule**

A. 1-2-3-4-5
B. 2-5-4-3-1
C. 3-5-1-4-2
D. 2-4-3-5-1
E. 5-4-3-2-1

(6,000 pts)

4) During active photosynthesis, which complex uses electron transport to pump protons across a membrane?

A. Photosystem I
B. Plastocyanin
C. Ferredoxin
D. Cytochrome b_6/cytochrome *f*
E. none of the above

(6,000 pts)

5) During active photosynthesis, which compartment in the chloroplast experiences a drop in pH?

A. intermembrane space
B. thylakoid lumen
C. matrix
D. stroma
E. cytoplasm

(6,000 pts)

6) Fixation of CO_2 occurs in the chloroplast and is considered the dark reaction of photosynthesis. To which molecule is CO_2 added in this reaction?

A. 3-Phosphoglycerate
B. Ribose-5-phosphate
C. Ribulose-1,5-bisphosphate
D. Glucose-1-phosphate
E. fructose-1,6-bisphosphate

(6,000 pts)

7) Jagendorf & Uribe (1966) provided direct evidence for the Chemiosmotic Theory. First they isolated intact chloroplasts and incubated them in a pH 4 buffer. The pH was then shifted to: _____.

What did they observe? _____

(6,000 pts)

8) Draw the structure of oleic acid. It is the acid form of oleate and is considered an ω-9 fatty acid.

(6,000 pts)

9) Which of the following fatty acids should have the lowest melting point?

A. C18:0
B. C16:0
C. C14:0
D. C16:cis-Δ^9
E. the melting points can not be compared

(7,000 pts)

10) In 1773 Ben Franklin put several mL of oil on a pond & carefully recorded its behavior. Describe the behavior of a single oil molecule in this expt. Diagrams are encouraged.

(6,000 pts)

11) Circle all that apply. Epinephrine signaling of an adipose cell results in:

A. phosphorylation of perilipin
B. dephosphorylation of perilipin
C. activation of the hormone sensitive lipase
D. inactivation of the hormone sensitive
E. hydrolysis of triacylglycerol
F. phosphorylation of triacylglycerol

(8,000 pts)

12) The transport of fatty acids (>10 carbons) into the mitochondrial matrix requires the direct use of the following enzymes. Number the enzymes (1-4) in the order of use.

____ acyl carnitine translocase
____ carnitine acyltransferase I
____ carnitine acyltransferase II
____ acyl CoA synthetase

(6,000 pts)

13) If a C16:0 fatty acid were oxidized completely to CO_2 in the mitochondria, how many ATP and H_2O could be generated by electron transport and oxidative phosphorylation?

_____ H_2O _____ ATP

(6,000 pts)

14) The ketone bodies, acetoacetate and D-3-hydroxybutyrate, result directly from high concentrations of:

A. Acetyl CoA in the cytoplasm
B. Acetyl CoA in the mitochondria
C. Malonyl CoA in the cytoplasm
D. Malonyl CoA in the mitochondria
E. Glucose in the cytoplasm
F. Glucose in the mitochondria

(6,000 pts)

15) Draw the structure of Malonyl CoA. You do not need to provide a structure for CoA.

(6,000 pts)

16) The production of malonyl CoA by acetyl CoA carboxylase requires the direct participation of which coenzyme?

A. $FADH_2$
B. NADH
C. NADPH
D. biotin
E. thiamine pyrophosphate

(6,000 pts)

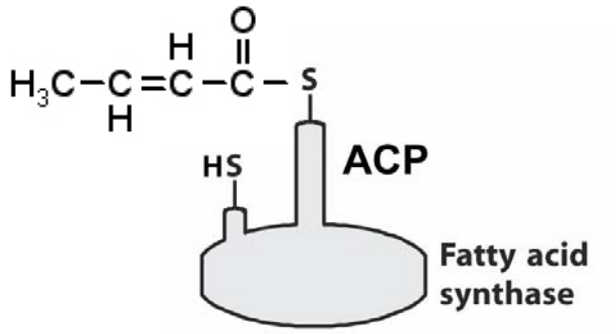
17) In which cellular compartment does fatty acid synthesis occur?

A. cytoplasm
B. nucleus
C. mitochondria
D. Golgi
E. peroxisome

(6,000 pts)

18) During fatty acid synthesis, the following molecule is formed. The next reaction in the synthesis would involve:

A. oxidation
B. reduction
C. hydration
D. dehydration
E. condensation
F. thiolysis



(6,000 pts)

19) Aspirin is an irreversible inhibitor of which enzyme?

A. fatty acid synthase
B. fatty acyl dehydrogenase
C. malonyl CoA synthase
D. cyclooxygenase
E. HMG CoA Reductase

(6,000 pts)

20) The statin drugs, including Lipitor, are competitive inhibitors of which enzyme?

A. fatty acid synthase
B. fatty acyl dehydrogenase
C. malonyl CoA synthase
D. cyclooxygenase
E. HMG CoA Reductase

(6,000 pts)

21) Draw a phospholipid (your choice). Provide a name.

(6,000 pts)

22) Total genomic DNA is isolated from a new species of animal. By following Chargaff's rules, which of the following would be expected to be true regarding this DNA?

A. [T] = [A]

B. [C] = [G]

C. [T] + [C] = [A] + [G]

D. all of the above

E. none of the above

(6,000 pts)

22) The structures on the right would be considered:

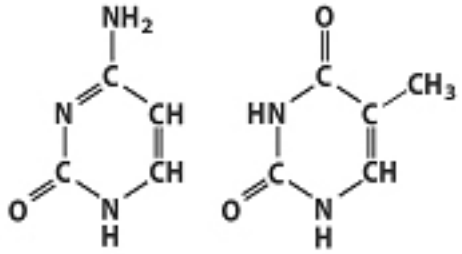
A. purine bases

B. pyrimidine bases

C. nucleotides

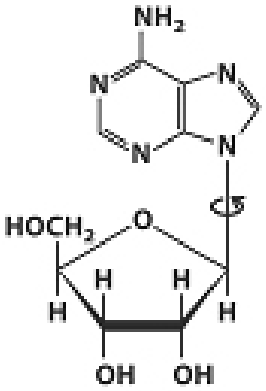
D. nucleosides

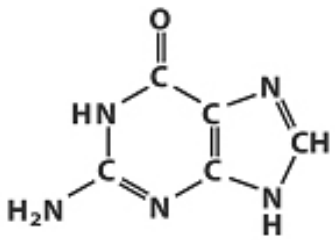
E. none of the above

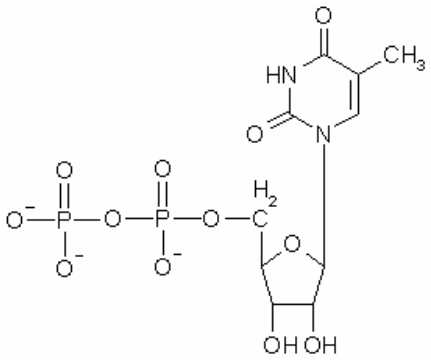


(9,000 pts)

23) Provide the full name for each structure







(4,000 pts)

24) The Watson and Crick structure (B form) of ds DNA has the following characteristics. Circle all that apply.

Helical Direction	**Base pairs per helical turn**
A. Right-handed	**A. ~8**
B. Left-handed	**B. ~10**
C. Left & right-handed	**C. ~12**
	D. ~14

(6,000 pts)

25) Exactly how do the nitrogenous bases differ between DNA and RNA?

A. there is no difference
B. RNA has uracil while DNA has thymidine
C. DNA has uracil while RNA has thymidine
D. DNA has a hydroxyl group removed from the 3′ position of the base
E. the RNA bases are incapable of hydrogen bonding

(8,000 pts)

Bonus: *Illustrate* using structures how the nitrogenous bases G & C hydrogen bond to one another.

Page #	Points	Points
2	32,000	
3	20,000	
4	18,000	
5	24,000	
6	27,000	
7	24,000	
8	24,000	
9	21,000	
10	10,000	
Bonus	8,000	
Total		