Chem.	454-Sp.	2006

EXAM 2

86 PTS.

NAME KEY

- I. Take home case-Online
- II. Problems (SHOW ALL WORK)
- 1. Sufferers of phenylketonuria (lack of phe hydroxylase) often have very light skin and hair. Explain. (5) The break down of Phe involves the synthesis of tyr. This is why tyr is not an essential amino acid. Since these people cannot make (much) tyr, they are also deficient in make (much) tyr, they are also deficient in melanin which is made from tyrusine. Thus their skin and hair are largely pigment free.
  - 2. Alcohol metabolism is really just <u>very short</u> chain fat metabolism. One of the last steps in alcohol breakdown involves conversion of acetate to acetyl CoA as shown. Propose an organic reaction mechanism to explain how this could occur.

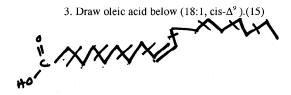
If the oxygens in acetate were labeled with <sup>18</sup> O, which product(s) would you expect to end up with the label? Show how in mechanism.(10)

CH<sub>3</sub>COO- + ATP + CoASH  $\rightarrow$  acetyl CoA + AMP + PPi

Ch<sub>3</sub>COO- + ATP + CoASH  $\rightarrow$  acetyl CoA + AMP + PPi

Ch<sub>3</sub>COO- + ATP + CoASH  $\rightarrow$  acetyl CoA + AMP + PPi

Ch<sub>3</sub>COO- Ad



a. Estimate the number (show work) of ATP's obtainable under healthy balanced diet aerobic conditions.

8 cycles & INADH x 2.5 = 20 ATP

(Isomerase) 7 // X IFADH x 1.5 = 10.5 ATP

ACTUATION

9 ACTUATION

118.5

b. Estimate the number (show work) of ATP's obtainable under aerobic conditions <u>but in a ketototic state</u> (no functional TCA).

c. Would any enzymes other than the normal β-oxidation enzymes be required?

If so which one(s)?

Y. CIS Dency (6 A 150 merase).

d. Draw one complete β-oxidation cycle with complete structures (OK, you can just write coenzyme A as CoA!). (Yuu could start any where!)

- 4. Give the structures <u>or</u> names of the aminotransferase products (transaminations) for the following (only where possible!):(12)
- a. pyruvate

 $\Rightarrow$  aluning

b. aspartate

oxaloace tate

NH2-C COH

**>** 

Or H - CH2-CH2-CH2 - COOH

(Give two different possibilities)

gabapentin  $\Longrightarrow$ 

H-c" (000H

$$\gamma$$
-amino butyric acid GABA  $\rightarrow$ 
 $H_3\dot{N}$ 

H'C - CH2-CH2-C-0-

5. Leucine is considered a *ketogenic* amino acid and asparagine is considered *glucogenic*. Using these amino acids as examples, describe what these terms mean (i.e. what products are they converted to immediately and eventually). What are the biochemical implications for a person on a low carbohydrate diet who eats protein rich in one or the other of these amino acids? That is, if one had to live on either on of these amino acids, which would be best and why. (8)

Ash is converted in a steps to exaloacetate. Lev is converted in more steps to acety lot and Aceto acetate. OAA can be used to make glucose; acetyl CoA and aceto acetate cannot. So ash is glucogenic and leverine strictly ketogenic, ketogenic refers to the fact that you could make ketone bodies but not glucose. Ash would be preferred for a low carb, diet since you can produce the glucore you need to feed your brain.

6. Identify the most likely additional substrates, reactants, products and cofactors like, e.g. O<sub>2</sub>, H<sub>2</sub>O, PLP, biotin, SAM, FAD, NAD, methylene-THF, formyl-THF, H<sub>4</sub>biopterin, etc., etc. for the purely imaginary pathway below.(10)

III. Matching Questions(10)	,
Use the following to answer questions 1-10:	
Choose the correct answer from the list below. Not	all of the answers will be used.
a) atmospheric nitrogen (N <sub>2</sub> )	
b) 3-phosphoglycerate	
c) histamine	
d) nitrogen fixation	
e) B <sub>12</sub>	
f) histidine	
g) tetrahydrofolate	
h) porphyrin	
i) glutamine hydrolysis	
j) glutathione	
k) PRPP (5-phosphoribosyl-1-pyrophosphate)	
l) ammonia (NH <sub>3</sub> )	
1. The original nitrogen source for	or the nitrogen found in amino acids.
λ	
$Q_2$ . The process of converting $N_2$ to $NH_3$ is called	······································
3 A common biochemical strates	gy by which ammonia can be generated
for use within the same enzyme.	
4. The precursor for serine, cysteine, and glycine	amino acid biosynthesis is
<u> </u>	
5. A versatile carrier of one-carbon units is	·
6. Methylcobalamine is derived from vitamin	·
•	
7. An activated form of ribose phosphate is	•
<b>h</b> 8. Glycine condenses with succinyl CoA in the fi	irst step of synthesis.
9. A vasodilator derived from histidine is	·
10. A tripeptide that functions as an antioxidant is	
IV. Multiple Choice (CHOOSE <u>THE BEST</u> ANSW	ER)(2 ea)
<b>5</b>	,
1. Why are triacylglycerols an excellent design for	
	D) a and b.
B) They are small.	a and c.
C) They are highly reduced.	

C 2	. Enzymes that digest the triacylglycerols into free fatty acids and monoacylglycerol ar called			
	A) hydrases. B) glyases. C) lipases.	D) E)	all of the above. none of the above.	
<b>B</b> 3	The hormone induction the process.  A) epinephrine; adrenocortic B) glucagon; insulin  C) insulin; norepinephrine  D) glucagon; epinephrine  E) epinephrine; glucagon	cotropic hormone		ibits
<u>_</u> 4	The function of the enzyme act A) lipolysis to release free g B) ATP-dependent reductio C) ATP-dependent activatio D) all of the above. E) none of the above.	lyceraldehyde. n prior to activatio n of fatty acids us	on. ing CoA.	
	Coenzyme(s) involved in the d A) FAD. B) NAD <sup>+</sup> . C) TF  The β oxidation of myristyl-Co A) 7 Acetyl-CoA + 7 FAD B) 6 Acetyl-CoA + 7 FAD C) 7 Acetyl-CoA + 6 FAD D) 7 Acetyl-CoA + 7 FAD E) 14 Acetyl-CoA + 12 FA	PP. D) a and b. (A (C-14:0)) yields $(B_2 + 7)$ NADH + $(B_2 + 7)$ NADH + $(B_4 + 7)$ NADH + $(B_4 + 7)$ NAD+	E) a, b, and c.  7 H <sup>+</sup> 7 H <sup>+</sup> 6 H <sup>+</sup>	
	How many rounds of β oxidati degraded to acetyl-CoA?  A) 16 B) 8 C) 7 D) 15  What types reactions do cob  A) intramolecular rearrange  B) methylations  C) reduction of ribonucleoti  D) a and c  E) a, b, and c	E) None of the a alamin enzymes c ments	atalyze?	e

## BODUS:(8)

Propose a plausible pathway (all steps) from the amino acid phenylalanine to the cactus hallucinogen mescaline. Include <u>all cofactors</u>, <u>reactants</u>, <u>enzyme cofactors and products</u> for each step like, *e.g.* O<sub>2</sub>, H<sub>2</sub>O, PLP, biotin, SAM, FAD, NAD, methylene-THF, formyl-THF, H<sub>4</sub>biopterin, etc., etc. You do not need to show mechanisms but draw intermediate structures.