

I. Take home case-Online

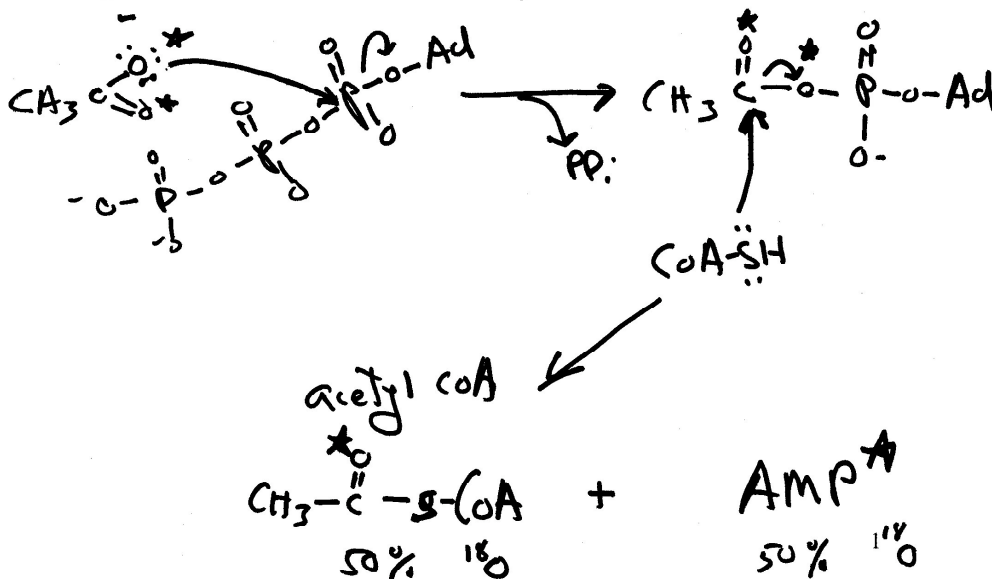
II. Problems (SHOW ALL WORK)

1. Sufferers of phenylketonuria (lack of phe hydroxylase) often have very light skin and hair. Explain.(5)

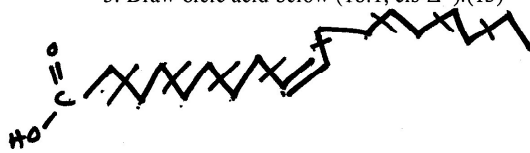
The breakdown of phe involves the synthesis of tyr. This is why tyr is not an essential amino acid. Since these people cannot make (much) tyr, they are also deficient in melanin which is made from tyrosine. Thus their skin and hair are largely pigment-free.

2. Alcohol metabolism is really just very short 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 ^{18}O , which product(s) would you expect to end up with the label? Show how in mechanism.(10)



3. Draw oleic acid below (18:1, cis- Δ^9). (15)



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

$$\begin{array}{l}
 8 \text{ cycles} \times 1 \text{ NADH} \times 2.5 = 20 \text{ ATP} \\
 \text{(isomerase)} \quad 7 \text{ " } \times 1 \text{ FADH}_2 \times 1.5 = 10.5 \text{ ATP} \\
 \text{activation} \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad - 2 \text{ ATP} \\
 9 \text{ Acetyl CoA} \times 10 \text{ ATP} = 90 \text{ ATP} \\
 \hline
 118.5
 \end{array}$$

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

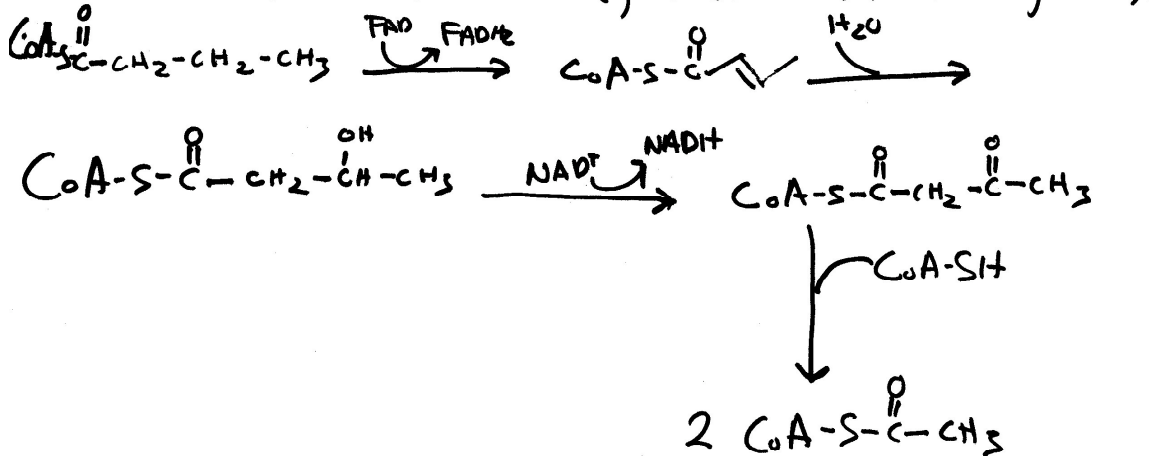
$$118.5 - 90 \text{ (no TCA)} = 28.5 \text{ ATP}$$

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

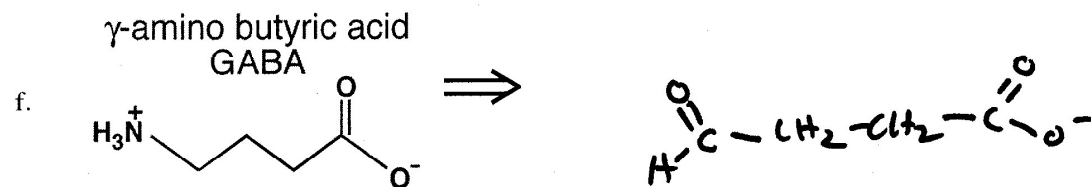
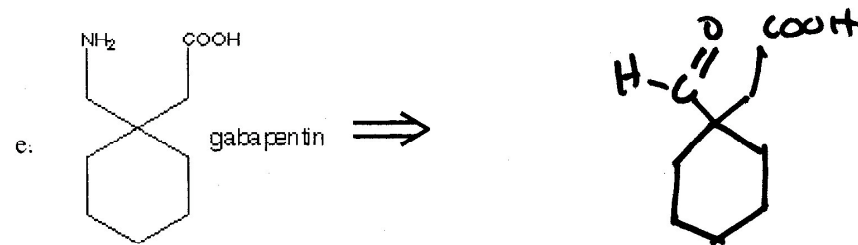
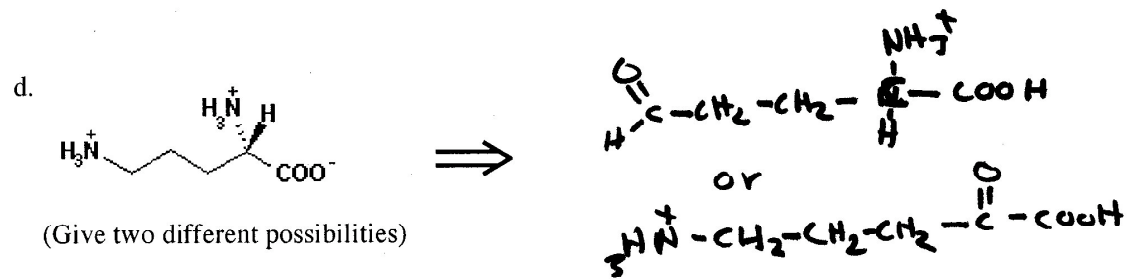
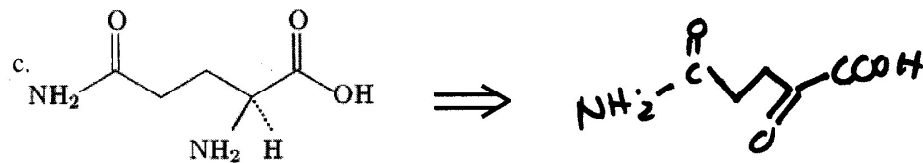
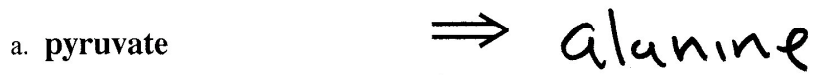
If so which one(s)?

Y. cis Δ^9 enoyl CoA isomerase

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



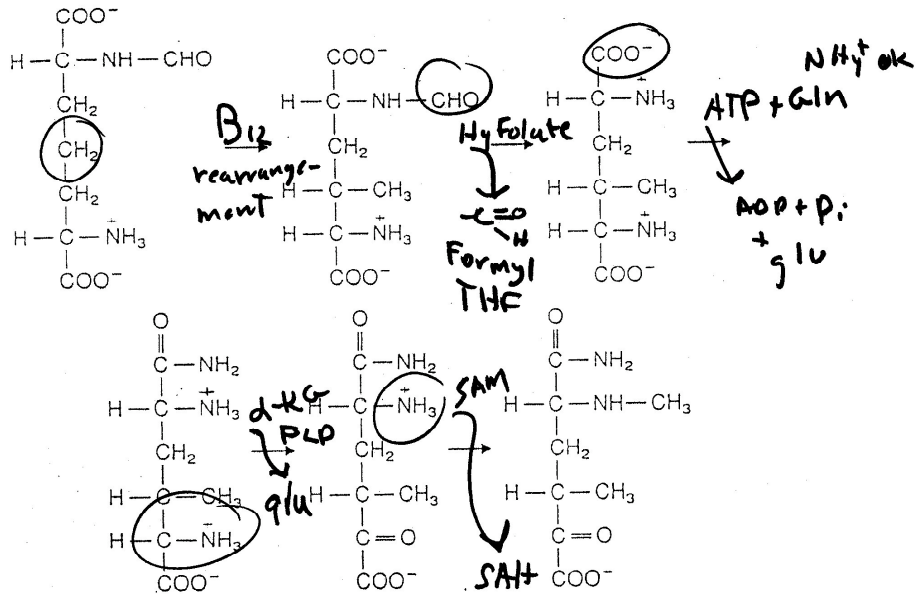
4. Give the structures or names of the aminotransferase products (transaminations) for the following (only where possible):(12)



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 one of these amino acids, which would be best and why. (8)

Asn is converted in 2 steps to oxaloacetate. Leu is converted in more steps to acetyl CoA and Acetoacetate. OAA can be used to make glucose; acetyl CoA and acetoacetate cannot. So asn is glucogenic and leucine strictly ketogenic. Ketogenic refers to the fact that you could make ketone bodies but not glucose. Asn would be preferred for a low carb. diet since you can produce the glucose you need to feed your brain.

6. Identify the most likely additional substrates, reactants, products and cofactors like, e.g. O₂, H₂O, PLP, biotin, SAM, FAD, NAD, methylene-THF, formyl-THF, H₄biopterin, 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_2)
- b) 3-phosphoglycerate
- c) histamine
- d) nitrogen fixation
- e) B_{12}
- f) histidine
- g) tetrahydrofolate
- h) porphyrin
- i) glutamine hydrolysis
- j) glutathione
- k) PRPP (5-phosphoribosyl-1-pyrophosphate)
- l) ammonia (NH_3)

- a 1. _____ The original nitrogen source for the nitrogen found in amino acids.
- d 2. The process of converting N_2 to NH_3 is called _____.
- i 3. _____ A common biochemical strategy by which ammonia can be generated for use within the same enzyme.
- b 4. The precursor for serine, cysteine, and glycine amino acid biosynthesis is _____.
- g 5. A versatile carrier of one-carbon units is _____.
- e 6. Methylcobalamine is derived from vitamin _____.
- k 7. An activated form of ribose phosphate is _____.
- h 8. Glycine condenses with succinyl CoA in the first step of _____ synthesis.
- c 9. A vasodilator derived from histidine is _____.
- j 10. A tripeptide that functions as an antioxidant is _____.

IV. Multiple Choice (CHOOSE THE BEST ANSWER)(2 ea)

- E 1. Why are triacylglycerols an excellent design for energy stores?
- A) They are anhydrous.
 - B) They are small.
 - C) They are highly reduced.
 - D) a and b.
 - E) a and c.

BOQUS:(8)

Propose a plausible pathway (all steps) from the amino acid phenylalanine to the cactus hallucinogen mescaline. Include all cofactors, reactants, enzyme cofactors and products for each step like, e.g. O_2 , H_2O , PLP, biotin, SAM, FAD, NAD, methylene-THF, formyl-THF, H_4 bipterin, etc., etc. You do not need to show mechanisms but draw intermediate structures.

