

BI/CH 422 & BI/CH 622

One-Hour Examination # 2

Wednesday, February 29, 2012

Name.....I.D.#.....

Please circle the course you are taking: BI 422; CH 422; BI 622; CH 622.

Answer each question briefly and concisely, preferably illustrated by a diagram.

1. How, in insect flight muscle, are the electrons of cytosolic NADH transported to the mitochondrial electron transport (E-T) chain? (3 marks)

Ans:

- In 3 steps:
- (1) $\text{DHAP} + \text{NADH} + \text{H}^+ \rightarrow 3\text{-P glycerol}$
 - (2) $3\text{-P glycerol} + \text{membrane-bound FAD} \rightarrow \text{FADH}_2 + \text{DHAP}$
 - (3) FADH_2 reoxidized to FAD with passage of 2e^- into the E-T chain

2. What are the roles of coenzyme Q and cytochrome c in the E-T chain? (2 marks)

Ans:

Electrons are transferred between Complexes I and III by the membrane-soluble CoQ and between Complexes III and IV by the peripheral membrane protein cytochrome c.

3. Using synthetic membrane vesicles, Stoeckenius & Racker demonstrated that a "proton motive force" (pmf) sufficed to form ATP from ADP and P_i . By means of a diagram, show
- (a) how this pmf was generated and
 - (b) how it enables ATP to be synthesized
- (4 marks)

Ans: (a) Illumination of bacteriorhodopsin pumps H^+ into the vesicle, which generates a proton motive force;

(b) H^+ accumulating inside the vesicle exits through the ATPase complex, the orientation of which is the reverse of normal. This enables ADP + P_i , brought together in the "tight" site of the $\text{F}_1\text{-ATP synthase}$, to be released as ATP when, with the passage of the H^+ , the proteins adopt the "open" configuration.

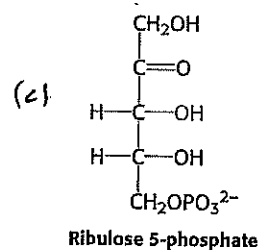
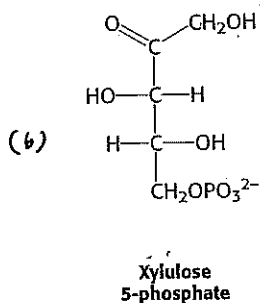
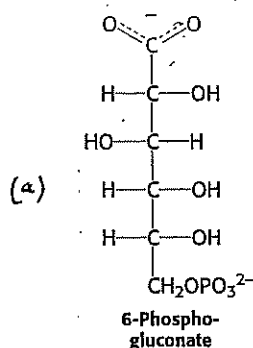
4. Why does the mitochondrial oxidation of succinate yield less ATP than does the oxidation of malate? (3 marks)

Ans:

Succinate oxidation involves the passage of electrons from FADH_2 to oxygen via Complexes II, III and IV, bypassing Complex I, to yield approx. 1.5 ATP.. Malate reacts initially with NAD to form $\text{NADH} + \text{H}^+$ which, on passing to oxygen via Complex I, III and IV, yields approx. 2.5 ATP

5. Identify the following compounds:

(3 marks)



6. Why were members of the Pythagorean Brotherhood forbidden to eat fava beans? (3 marks)

Ans:

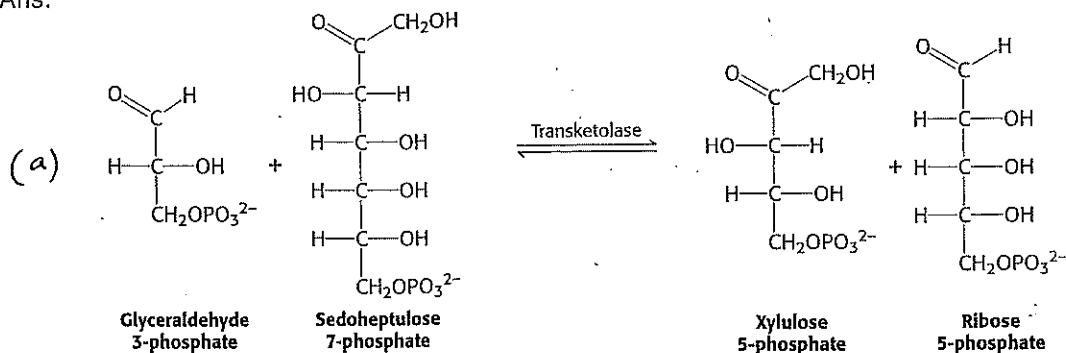
Fava beans contain toxic principles that increase demand for NADPH (needed to maintain glutathione in the reduced, GSH, state) to a level that people deficient in glucose 6-P dehydrogenase cannot meet. This deficiency is particularly prevalent in Mediterranean populations such as those from which the followers of Pythagoras were drawn.

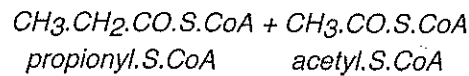
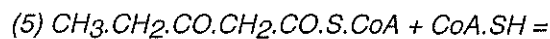
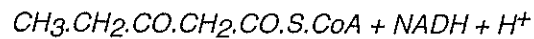
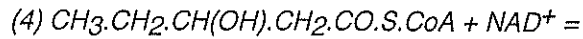
7. Using structural formulae, write down the products of the interaction of glyceraldehyde 3-P and sedoheptulose 7-P as catalysed by

- (a) transketolase, and
- (b) transaldolase

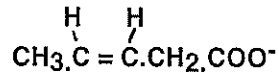
(6 marks)

Ans:





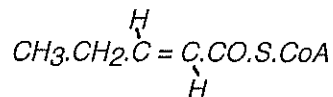
11. In what ways does the sequence of reactions for the similar oxidation of



differ from that in question 10. ?

(2 marks)

Ans: *Enoyl CoA isomerase effects conversion of the CoA-derivative from the cis Δ3 to trans Δ2*

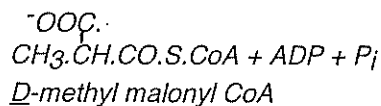


Thereafter, reactions are identical from (2) to (5) above

12. What are the reactions by which the **propionyl.S.CoA**, formed in 10. and 11. above, is fed into the Tricarboxylic Acid Cycle?

(3 marks)

Ans: (1) $\text{CH}_3.\text{CH}_2.\text{CO.S.CoA} + \text{CO}_2 + \text{ATP} \Rightarrow$



(Bonus mark for role of biotin)

