

Points

- (12) 1. Pyruvate kinase has a very large negative ΔG° , and so the reaction operates with a large negative ΔG and is essentially irreversible.
- (a) How do animal cells carry out the conversion of pyruvate to phosphoenol pyruvate? Give the reactants, products, (names or structures) and the name(s) of the enzyme(s) involved.

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- (b) How do C-4 plant cells carry out this conversion? Give the reactants, products, (names or structures) and the name(s) of the enzyme(s) involved.

- (10) 2. Give the name and structure of the products formed when sedoheptulose-7-phosphate reacts with glyceraldehyde-3-phosphate in the presence of:

(a) Transketolase

(b) Transaldolase

- (4) 3. **Wernicke-Korsakoff** syndrome is a mental disorder coupled with loss of memory and partial paralysis. It is an example of a condition dependent on both genetic and environmental factors, and involves **transketolase**. Explain the enzyme defect and the environmental factors involved.

(12) 4. **Phosphofructokinase-1** and **phosphofructokinase-2** both catalyze a reaction between fructose-6-phosphate and ATP. Compare and contrast these two enzymes with respect to:

(a) structure of the product of each reaction (draw structure).

(b) further metabolism of the product of each reaction (i.e. what enzyme(s) act on each product?)

(c) regulation of the activity of each enzyme.

(11) 5. Diagram the **thylakoid membrane**, identifying the space on each side of it. On your diagram place, in proper orientation, the following:

CF₁, CF_o, plastocyanin, pigment system I, pigment system II, cytochrome b/f complex, direction of proton movement by the cytochrome complex, site of O₂ production, site of NADPH production, Rubisco, and ferredoxin .

6. The stimulation of glycogen breakdown by hormones was the first experimental system in which a "second messenger" signaling pathway was demonstrated for the ultimate activation of the enzyme **phosphorylase**. This pathway acts as a "cascade" in that the product in each step is a catalyst for the next step, resulting in an amplification of the signal.
- (8) (a) Diagram this signaling pathway for **muscle**, indicating all the intermediate steps and intermediates from the first interaction of the hormone (including identification of the primary hormone involved) with the cell to the covalent modification of phosphorylase.
- (4) (b) What is the identity of the "second messenger" in this scheme (draw its structure), identify the protein it activates, and describe how it interacts with that protein.
- (6) (c) Name four enzymes or proteins in muscle whose activities are affected when covalently modified by the activated protein described in part (b). For each, indicate whether the modified protein is **activated** or **inhibited**.

