

Please do the easiest first. Ask for clarification of any question.

1. (3 ea) Define clearly and concisely:

a. oxidative phosphorylation

b. photorespiration

c. anaplerotic reaction

2. Consider the **pyruvate dehydrogenase complex** and the reaction that it catalyzes.

a. (4) Outline two modes of regulation of its catalytic activity.

b. (4) Explain the metabolic logic behind this regulation.

3. Questions on oxidative phosphorylation (ox phos) – fill in the blanks (1 pt ea):

a. Operation of the citric acid cycle furnishes 2 compounds as “inputs” to ox phos. Name them.

#1

#2

b. Operation of ox phos is essential to the chemistry that occurs in the citric acid cycle because it regenerates

the _____ form of the above 2 compounds.

c. The “inputs” to ox phos provide _____ pairs at high _____.

These are passed through a series of carriers to _____ as the final acceptor, producing

_____ as the waste product.

d. Each successive carrier has a more _____ E° value than the one that precedes it.

e. The energy released as electrons are passed is used to _____ from the mitochondrial

region called the _____ to the _____ side of the inner membrane.

f. The _____ gradient that is generated is harnessed to synthesize _____.

4. You have a liver homogenate capable of normal metabolic activity (its mitochondria are intact and functional). It is supplied with ample O_2 , P_i and ADP. To it you add 3.0 μ moles of dihydroxyacetone phosphate (DHAP) labeled at C2 with ^{14}C at 5000 cpm/ μ mole. When action ceases, ...

[Show enough work that I can follow your logic in the large space below, and gather your answers in the smaller spaces provided for them]

a. (3) Name and give μ moles produced of the compound(s) whose C originated from those of DHAP.

b. (3) Show the location of ^{14}C and give the specific radioactivity of each labeled compound in (a).

c. (6) How many μ moles of ATP will form? _____

d. (4) How many μ moles of O_2 will be consumed? _____

5. Repeat Problem 4 in the presence of enough malonate to stop succinate dehydrogenase activity (again, “wait” until action ceases). You need not show portions of logic that are the same as for Problem 4, but do keep count of important compounds generated or consumed in those portions. Clearly show changes in carbon flow, labeling and compound generation/consumption caused by the presence of malonate.

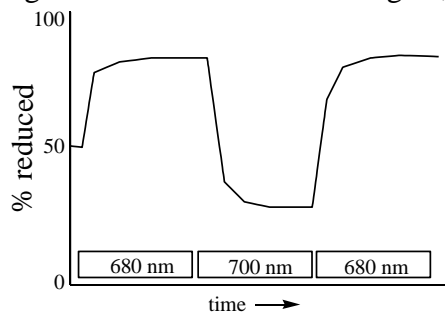
a. (6) Compounds present and μmoles of each?

b. (8) ^{14}C locations? Specific radioactivity of labeled compounds?

c. (6) μmoles of ATP produced?

d. (4) μmoles of O_2 consumed?

6. (10) Explain the significance of the results shown. Chloroplasts were illuminated with monochromatic light of the indicated wavelengths, and the redox status of their cytochrome f was monitored.



7. (8) Explain how green plants can produce varying ratios of ATP/NADPH, depending on demand for each.

8. (10) You have a suspension of mitochondria supplied with O_2 , P_i and ADP. Show how all C atoms of added fumarate are converted to CO_2 . Assume that the inner membrane is permeable to fumarate, malate and pyruvate, but not to OAA. Keep in mind that mitochondria will not tolerate a significant increase in the concentration of any citric acid cycle intermediate, and that mitochondria make all the AcCoA that is used - you do not add any. You may use *abbreviations or acronyms instead of structures*. Show what happens both in the cytoplasm and inside the mitochondria using an appropriately labeled flow diagram.