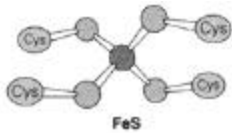
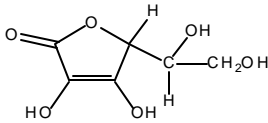


1. Give the names of the following cofactors/vitamins:

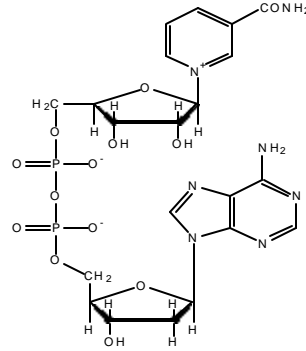
A.



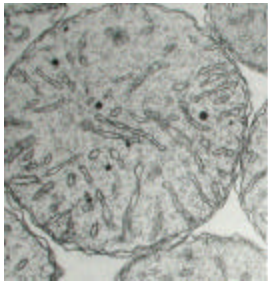
B.



C.



2. Which picture (A or B) do you think represents the more actively respiring mitochondria? Why?...



(A)



(B)

3. Use the table to answer the following 2 questions:

Oxidant	Reductant	<i>n</i>	E'_0, V
Acetate + CO ₂ + 2H ⁺	Pyruvate + H ₂ O	2	-0.70
Succinate + CO ₂ + 2H ⁺	α -Ketoglutarate + H ₂ O	2	-0.67
Acetate + 3H ⁺	Acetaldehyde + H ₂ O	2	-0.60
O ₂	O ₂ ⁻	1	-0.45
Ferredoxin (oxidized)	Ferredoxin (reduced)	1	-0.43
2H ⁺	H ₂	2	-0.42
Acetoacetate + 2H ⁺	β -Hydroxybutyrate	2	-0.35
Pyruvate + CO ₂ + H ⁺	Malate	2	-0.33
NAD ⁺ + H ⁺	NADH	2	-0.32
NADP ⁺ + H ⁺	NADPH	2	-0.32
FMN (enzyme-bound) + 2H ⁺	FMNH ₂ (enzyme-bound)	2	-0.30
Lipoate (oxidized) + 2H ⁺	Lipoate (reduced)	2	-0.29
1,3-Bisphosphoglycerate + 2H ⁺	Glyceraldehyde-3-phosphate + P _i	2	-0.29
Glutathione (oxidized) + 2H ⁺	2 Glutathione (reduced)	2	-0.23
FAD + 2H ⁺	FADH ₂	2	-0.22
Acetaldehyde + 2H ⁺	Ethanol	2	-0.20
Pyruvate + 2H ⁺	Lactate	2	-0.19
Oxaloacetate + 2H ⁺	Malate	2	-0.17
α -Ketoglutarate + NH ₄ + 2H ⁺	Glutamate + H ₂ O	2	-0.14
Methylene blue (oxidized) + 2H ⁺	Methylene blue (reduced)	2	0.01
Fumarate + 2H ⁺	Succinate	2	0.03
CoQ + 2H ⁺	CoQH ₂	2	0.04
Cytochrome <i>b</i> (+3)	Cytochrome <i>b</i> (+2)	1	0.07
Dehydroascorbate + 2H ⁺	Ascorbate	2	0.08
Cytochrome <i>c</i> ₁ (+3)	Cytochrome <i>c</i> ₁ (+2)	1	0.23
Cytochrome <i>c</i> (+3)	Cytochrome <i>c</i> (+2)	1	0.25
Cytochrome <i>a</i> (+3)	Cytochrome <i>a</i> (+2)	1	0.29
½O ₂ + H ₂ O	H ₂ O ₂	2	0.30
Ferricyanide	Ferrocyanide	2	0.36
Nitrate + 2H ⁺	Nitrite + H ₂ O	1	0.42
Cytochrome <i>a</i> ₃ (+3)	Cytochrome <i>a</i> ₃ (+2)	1	0.55
Fe (+3)	Fe (+2)	1	0.77
½O ₂ + 2H ⁺	H ₂ O	2	0.82

Note: E'_0 is the standard reduction potential at pH 7 and 25°C, *n* is the number of electrons transferred, and each potential is for the partial reaction written as follows: Oxidant + $ne^- \rightarrow$ reductant.

A. What is the E'_0 in Volts for the reaction catalyzed by succinate dehydrogenase ("succinate-ubiquinone oxidoreductase")? [Assume that the terminal acceptor of electrons is FAD.]

B. Is the reaction favorable? If not, will it be favorable if Coenzyme Q is instead the electron acceptor? [show your work]

4. We have discussed 5 transport systems by which substrates/metabolites are moved across the mitochondrial inner membrane. Choose 2 examples, state which molecules are being moved and in which direction, and indicate why the process is energetically favorable.

A.

B.

5. In respiring mitochondria (i.e. in the presence of oxygen and FADH and NADH), will cytochrome c ("cyt c") be (A) OXIDIZED or (B) REDUCED under the following conditions?

_____ Antimycin A is added

_____ Azide is added

6. All of the following are uncouplers except:

- A. Nigericin
- B. Dinitrophenol
- C. Oligomycin
- D. Valinomycin
- E. All of the above are uncouplers

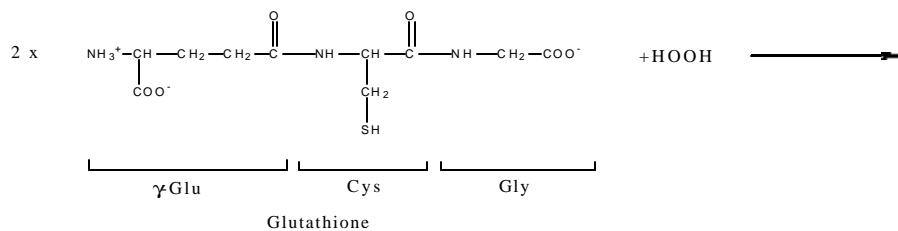
7. Which statement about the ATP Synthase is FALSE?

- A. Oligomycin binds to the F1 subunit and inhibits the enzyme
- B. The binding sites in the enzyme undergo a conformational change to switch between 3 states
- C. The F_O portion of the enzyme projects into the mitochondrial matrix
- D. The γ subunit has been shown to actually rotate

8. What is the P/O ratio if respiring mitochondria were fed b-hydroxybutyrate and antimycin?

- A. 0
- B. 1
- C. 2
- D. 3

9. Draw the products of the following reaction:



10. Given that $\Delta p = \Delta \Psi - Z \Delta \text{pH}$, and that the pH gradient is 0.5 units across the mitochondrial inner membrane and the membrane potential is -0.17V, does the electrical or chemical component of the gradient contribute more to the proton motive force? [show your work; Z=0.059 V]