

Please keep your blue and just turn in this sheet (cut off the top part for your records)

Chem 431a Quiz 10. Place your answers in the bottom half of the page. When you are done, cut the paper and keep the top half of the page for your review and submit the bottom half.

(1) Consider the inner mitochondrial membrane. The pH gradient across the membrane drives the synthesis of ATP from ADP + P₁. Assume that the membrane potential across the membrane is 70 mV with the outside being + and that the pH is 5.0 outside and 8.0 inside.

- a) Draw a membrane showing the 2 chambers and the direction of flow of the protons. [1pt]
b) Assuming that the synthesis of ATP requires the standard value of 30.5 kJ/mol, how many protons (integer please) would be required to synthesize a molecule of ATP?[4 pts]

KEY: we have: (in) pH 8.0, <---(-)|| (+)--- , pH. 5.0 (out)

So ΔG for transfer of 1 mole H⁺: $\Delta G = 2.303RT \log \{ [H^+]_{in}/[H^+]_{out} \} + ZF(Y_{in}-Y_{out})$

$$=(2.303)(8.314\text{J/molK})(298\text{K})(\log[H^+]_{in}-\log[H^+]_{out}) + (+1)(96500\text{C/mol})(-70.0\text{mV})(10^{-3}\text{V/mV})$$

$$=5706\text{J/mol}(-\text{pH}_{in}+\text{pH}_{out}) -6755\text{ CV/mol} = 5706(-8.0+5.0)\text{J/mol} -6755\text{J/mol} =-23900\text{ J/mol}\approx-24\text{kJ/mol}$$

Each mol of ATP synthesized requires 30.5kJ so, we need about $(30.5\text{kJ}/24\text{kJ})=1.3$ moles H⁺

For each molecule of ATP synthesized, we would need more than 1 H⁺, we would need at least 2 H⁺ flowing.

(2) Explain why phospholipids can spontaneously form lipid bilayers while triacylglycerols cannot. [2 pts]

(3) List 3 ways to distinguish between facilitated and simple diffusion. [3pts]

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Your name _____ Testbook number _____

Your answers: