

Name _____

Use complete sentences when requested. There are 100 possible points on this exam.

Exam Memory Bank

$V_0 = \frac{V_{\max} \times [S]}{K_m + [S]}$ $V_{\max} = k_{cat} \times E_t$ $k_{cat} = \frac{kT}{h} \times e^{\frac{-G^\ddagger}{RT}}$ $\Delta G = \Delta H - T\Delta S$	$\Delta G^{\circ'} = -nF\Delta E^{\circ'}$ $\Delta G^{\circ'} = -RT \ln K_{eq}^{\circ'}$ $\Delta G_t = RT \ln \frac{c_2}{c_1}$ $\Delta G_t = RT \ln \frac{c_2}{c_1} + ZF\Delta\psi$	$R = 8.314 \text{ J/mol}\cdot\text{K}$ $F = 96,500 \text{ J/V}\cdot\text{mol}$ Boltzman constant, $k = 1.381 \times 10^{-23} \text{ J/K}$ Plank's constant, $h = 6.626 \times 10^{-34} \text{ J}\cdot\text{sec}$ Avogadro's number, $6.02 \times 10^{23} / \text{mol}$ $\ln x = 2.303 \log_{10} x$ calorie = 4.184 J
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- (10 points) ATP is synthesized in the mitochondrial matrix by coupling the energy from proton flow into the matrix with ATP synthesis. Calculate the energy that is available for ATP synthesis when 3 moles of protons flow into the mitochondrial matrix. The pH inside the mitochondrial matrix is 7.4, the pH outside the matrix is 6.8. The membrane potential is 60mV (inside is negative).

6. (10 points) Fully describe the mechanism involved in terminating the light signal and what happens to the light receptor system after signal. Please use complete sentences.
7. (15 points) The hydrolysis of ATP is spontaneous and has a negative $\Delta G'^{\circ}$ (-30.5kJ/mole)
- Why does ATP have more potential energy than ADP and P_i ? Please use complete sentences.
 - ATP is quite stable and can last in the refrigerator for months, how is this possible. Why doesn't it hydrolyze quickly?

- c. If the cellular concentrations are as follows: $[ATP] = 8 \text{ mM}$ $[ADP] = 0.15 \text{ mM}$ $[P_i] = 2 \text{ mM}$, what is the ΔG for the hydrolysis of ATP in a cell at 37°C .

8. (20 points) Describe everything that happens in a cell when insulin binds to an insulin receptor.