Name_

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

Exam Memory Bank $V_0 = \frac{V_{\text{max}} \times [S]}{K_m + [S]}$	ΔG"'=- <i>nF</i> ΔE"'	R = 8.314J/molxK F = 96,500J/Vxmol
	$\Delta G^{"} = -RTInK_{eq}^{"}$	Boltzman constant, k=1.381×10 ⁻²³ J/K
$V_{\text{max}} = k_{cat} \times E_t$ $k_{cat} = \frac{kT}{h} \times e^{\frac{-G^*}{RT}}$	$\Delta G_t = RT \ln \frac{c_2}{c_1}$	Plank's constant, h=6.626×10 ⁻³⁴ Jxsec Avogadro's number, 6.02×10 ²³ /mol In x=2.303log ₁₀ × calorie=4.184J
ΔG=Δ <i>H-T</i> ΔS	ΔG_t = $RTIn \frac{G_2}{G_1}$ + $ZF\Delta$ ψ	

1. (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).

2. (10 points) Describe how p53, p21 and Rb are involved in regulating the cell cycle. Please use complete sentences.

3. (15 points) The cell cycle is regulated by the cyclins and cyclin dependent kinases. There are four general ways that these complexes are regulated. Describe how the cyclins and cyclin dependent knases are controlled. Please use complete sentences.

4. (10 points) How do steroid hormones alter gene expression? Please use complete sentences.

5. (10 points) Fully describe how light results in a signal to the brain. Please use complete sentences.

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 ΔG° (-30.5kJ/mole)
 - a. Why does ATP have more potential energy than ADP and Pi? Please use complete sentences.

b. ATP is quite stable and can last in the refrigerator for months, how is this possible. Why doesn't it hydrolyze quickly?

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