Exam II **NAME:**____

$h = 1.584 \times 10^{-34}$ cal · s
$c = 2.998 \times 10^{8}$ m · s^{-1}
$\Im = 23{,}060$ cal · V^{-1} · mol^{-1}
$E = hc/\lambda$
$\Delta G^{0\prime} = -n\Im\Delta E^{0\prime}$
$N_A = 6.022 \times 10^{23}$ mol^{-1}
R = 1.99 cal mol^{-1} K^{-1}

1.) 10 pts
2.) 10 pts
3.) 10 pts
4.) 10 pts
5.) 30 pts
6.) 30 pts

1.) Photosystem II is 66.3% efficient at capturing the energy contained in a photon with a wavelength of 680 nm. What is the change in standard reduction potential ($\Delta E^{0\prime}$) from the ground to excited state of Photosystem II? (Include units and show work)

2.) To quantify the total number of electrons transferred in solution during a redox reaction, you utilize DCPIP ($\varepsilon_{600\ nm\ (oxidized)}$ = 16.9 $mM^{-1} \cdot cm^{-1}$) as an electron acceptor/donor. The starting DCPIP solution is colorless and is utilized to blank the spectrophotometer. After the reaction goes to completion, a 1:5 dilution of the reaction has an absorbance of 0.56 at 600 nm. ***(i)*** Is this reaction oxidizing or reducing DCPIP? ***(ii)*** How many total electrons were transferred to DCPIP molecules during the reaction? (show your work)

3.) Describe the major ***(i)*** difference and the major ***(ii)*** similarity in the mechanism of regulation of the citric acid cycle as compared to glycolysis. (Only one sentence is needed for each.)

4.) People with beriberi, a disease caused by thiamine and TPP deficiency, have elevated levels of blood pyruvate and α-ketoglutarate, especially after consuming a meal rich in glucose. Explain this clinical manifestation utilized to diagnosis beriberi.

5.) Imagine that the acyl-CoA molecule containing Arachidic acid (20:0) is completely metabolized through the process of β-oxidation, the citric acid cycle, and the electron-transport chain.

a. How many rounds of β-oxidation are required?

b. How many <u>total</u> $FADH_2$ will be produced from these β-oxidation rounds?

c. How many <u>total</u> NADH will be produced from these β-oxidation rounds?

d. How many <u>total</u> acetyl-CoA will be produced from these β-oxidation rounds?

e. How many <u>total</u> NADH will be produced as these acetyl-CoA (from part d) are processed through the citric acid cycle?

f. How many <u>total</u> $FADH_2$ will be produced as these acetyl-CoA (from part d) are processed through the citric acid cycle?

g. How many <u>total</u> GTP will be produced as these acetyl-CoA (from part d) are processed through the citric acid cycle?

h. How many <u>total</u> CO_2 will be produced as these acetyl-CoA (from part d) are processed through the citric acid cycle?

i. How many <u>total</u> NADH and $FADH_2$ are produced by the processes of β-oxidation and the citric acid cycle (i.e. sum of parts b+c+e+f)?

j. If all the NADH and $FADH_2$ molecules (part i) pass their electrons to ubiquinone, how many electrons will be transferred?

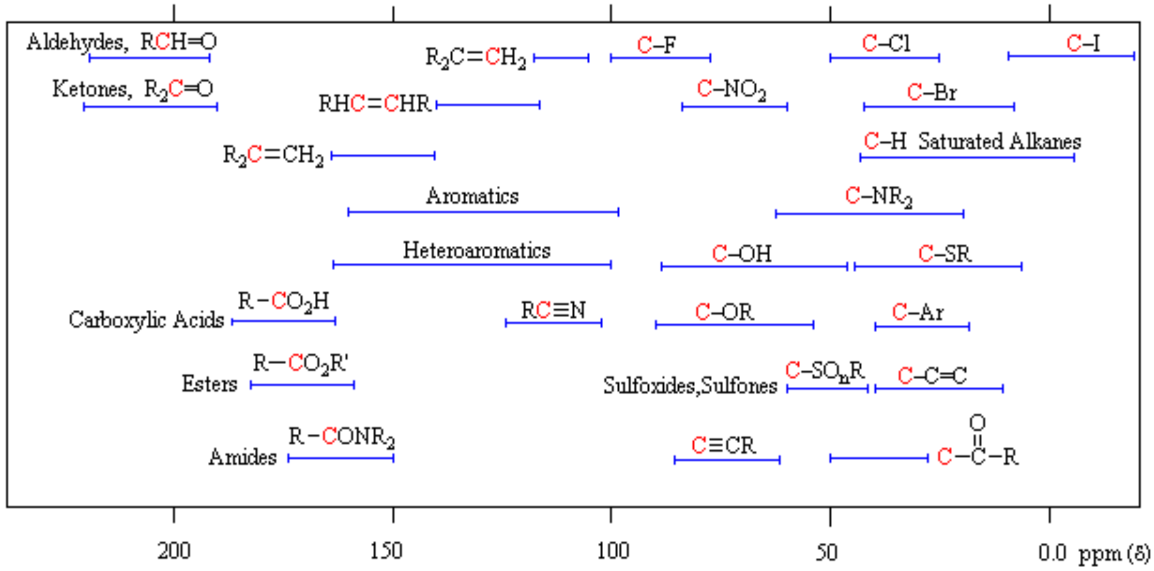
k. How many <u>total</u> ubiquinones will be reduced in part j?

l. How many protons will be pumped from the matrix to the inner membrane space during part j?

m. How many Cytochrome C will be reduced by the ubiquinones (in part k) in Complex III?

n. How many protons will be pumped from the matrix to the inner membrane space by Complex III?

o. How many <u>total</u> water molecules will be produced by Complex IV?



6.) ***(i)*** List the name of the enzymes that catalyze each step of the citric acid cycle below. ***(ii)*** Place a circle around the name of enzymes that catalyze reactions that generate NADH. ***(iii)*** Place a square around the name of enzymes that catalyze reactions that generate $FADH_2$. ***(iv)*** Place a star next to the name of enzymes that catalyze reactions that generate GTP. ***(v)*** If C2 (methyl group) of acetyl-CoA were labeled with ^{13}C, list the range of ppm values expected for the product of each catalyzed reaction below for the first round of the cycle.

Enzyme Names	**PPM Range**