Exam Memory Bank

$$V_0 = \frac{V_{max} \times [S]}{K_m + [S]}$$

$$V_{max} = k_{cat} \times E_t$$

$$k_{cat} = \frac{kT}{h} \times e^{\frac{-G^{\ddagger}}{RT}}$$

$$\Delta G = \Delta H - T\Delta S$$

$$\Delta G^{\circ\prime} = -nF\Delta E^{\circ\prime}$$

$$\Delta G^{\circ\prime} = -RT\ln K_{eq}^{\circ\prime}$$

$$\Delta G_t = RT\ln\frac{c_2}{c_1}$$

$$\Delta G_t = RT\ln\frac{c_2}{c_1} + ZF\Delta\psi$$

R = 8.314J/molxK

F = 96,500J/Vxmol

Boltzman constant, $k=1.381\times10^{-23}$ J/K

Plank's constant, $h=6.626\times10^{-34}$ Jxsec

Avogadro's number, 6.02×10^{23}/mol

ln x=2.303log10x

calorie=4.184J

Calculate the ΔG : Calculate an E value for both half reactions. Write both half reactions as reduction reactions.

1. $E = E° + \frac{RT}{nF} \ln \frac{[\text{acceptor}]}{[\text{donor}]}$
2. Subtract the half reaction E values : $\Delta E = E_{red} - E_{ox}$,
3. Use the Nernst Equation: $\Delta G = -nF\Delta E$

The electron acceptor is the oxidized form, the electron donor is the reduced form.

For NAD+ + 2H+ + 2 e- -→ NADH, H+

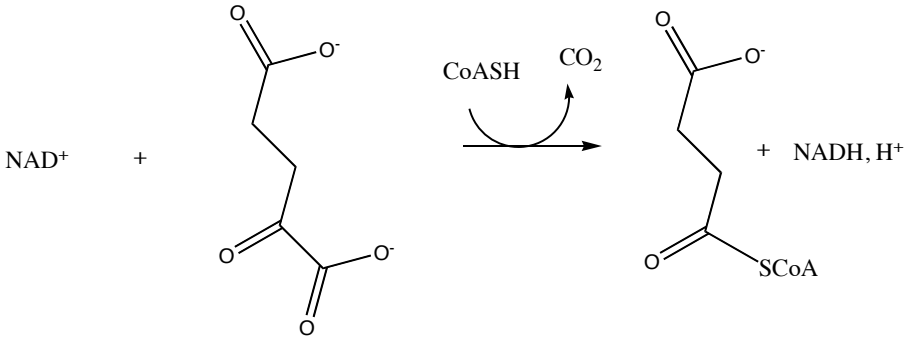
The acceptor is _____

The donor is_____

Standard Reduction Potentials for Several Biological Reduction Half-Reactions Reduction Half-Reactions

	$E_o°$ (V)
$O_2 + 2H^+ + 2\ e^- \rightarrow H_2O$	0.816
$FAD + 2\ H^+ + 2\ e^- \rightarrow FADH_2$ (FAD is bound to proteins, so E° is variable)	0.003 to -.220
Oxaloacetate + $2\ H^+ + 2\ e^-$ → malate	0.060
Fumarate + $2\ H^+ + 2\ e^-$ → succinate	0.031
Pyruvate + $2\ H^+ + 2\ e^-$ → lactate	-0.185
Lipoic acid + $2\ H^+ + 2\ e^-$ → dihydrolipoic acid	-0.290
1 ,3-Bisphosphoglycerate + $2\ H^+ + 2\ e^-$ → glyceraldehyde-3-phosphate+P_i -	-0.290
$NAD^+ + 2\ H^+ + 2\ e^-$ → NADH + H^+	-0.320
α-Ketoglutarate + $CO_2 + 2\ H^+ + 2\ e^-$ → isocitrate	-0.3802
½ N_2 + $4H^+$ + $3e^-$ → NH_4^+	-.342
Succinyl CoA + $CO_2 + 2\ H^+ + 2\ e^-$ → α-ketoglutarate + H_2O + CoASH	-0.670

1. Use the table provided to answer the following questions:
   a. What is the free energy change for the TCA cycle reaction shown below at standard conditions? (Calculate $\Delta G°'$)



b. Reduced flavin adenine dinucleotide ($FADH_2$)can transfer electrons to nicotine adenine dinucleotide (NAD^+). Show the two half reactions. Clearly label the oxidation reaction and the reduction half reaction. Calculate $\Delta G°'$

c. Why is oxygen best suited to be the terminal electron acceptor in the electron transport chain?

d. Calculate the ΔG for the following reaction:

glyceraldehyde-3-phosphate	+	P_i	+	NAD^+	→	1 ,3-Bisphosphoglycerate	+	NADH, H+
(0.02M)		(10 mM)		(9μM)		(0.01M)		(1μM)