$$\Delta G^{\circ} = -n\mathcal{F}\Delta\varepsilon^{\circ\prime}$$

$$F = 96\ kJ \cdot mol^{-1} \cdot V^{-1}$$

Location in ETC	oxidized form		reduced form	n	$\varepsilon^{\circ\prime}$ (V)
Metabolism	$NAD^{+} + H^{+} + 2e^{-}$	$\rightarrow$	$NADH$	2	-0.32
Complex I	$Q + 2H^{+} + 2e^{-}$	$\rightarrow$	QH_2	2	0.04
Complex III	$cytochrome\ b\ (Fe^{3+}) + e^{-}$	$\rightarrow$	$cytochrome\ b\ (Fe^{2+})$	1	0.08
Cytochrome C	$cytochrome\ c\ (Fe^{3+}) + e^{-}$	$\rightarrow$	$cytochrome\ c\ (Fe^{2+})$	1	0.24
Complex IV	$\frac{1}{2}O_2 + 2H^{+} + 2e^{-}$	$\rightarrow$	H_2O	2	0.82

1. What do you notice about $\varepsilon^{\circ\prime}$ along the electron transport chain? Why do you think it is arranged this way?

INCREMENTAL INCREASE IN $\varepsilon^{\circ\prime}$. GIVES DIRECTION OF FLOW. CONTROLLED RXN.

2. How, energetically, does pumping H^{+} across a bilayer "store" energy? Can you think of a macro-scale example that works this way?

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3. If you had to guess, which steps transport H^{+} across the bilayer? Why?

BIGGEST $\Delta\varepsilon^{\circ\prime}$ $\rightarrow$ MOST ENERGY TO DO WORK.

4. How much energy is released per pair of e^{-} (in $kJ \cdot mol^{-1}$) in the oxidation of NAD^{+} by O_2?

$\Delta\varepsilon^{\circ\prime} = 0.815 - -0.32 = 1.135\ V$

$\Delta G = -(2)(96)(1.135) = -218\ kJ/mol$

5. If it "costs" 30.5 $kJ \cdot mol^{-1}$ to catalyze $ADP + P_i \rightarrow ATP$, how many ATP could (theoretically) be produced by this oxidation?

$218/30.5 \rightarrow 7.1$ ATP/NADH