

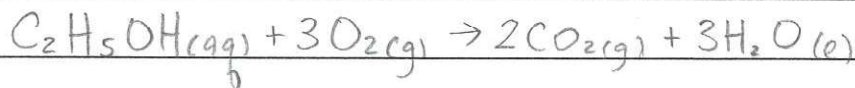
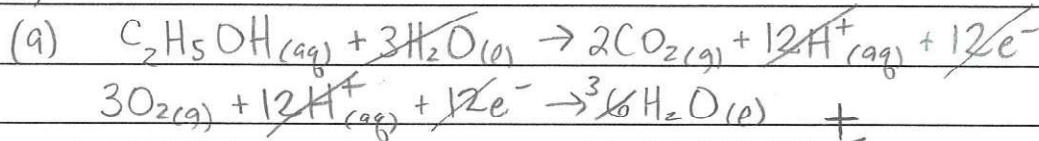
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46 Form B
AP Free Response Practice! (2015 #1)

Half-Reaction	E° (V)
$2 \text{CO}_2(\text{g}) + 12 \text{H}^+(\text{aq}) + 12 \text{e}^- \rightarrow \text{C}_2\text{H}_5\text{OH}(\text{aq}) + 3 \text{H}_2\text{O}(\text{l})$	-0.085
$\text{O}_2(\text{g}) + 4 \text{H}^+(\text{aq}) + 4 \text{e}^- \rightarrow 2 \text{H}_2\text{O}(\text{l})$	1.229

$\Rightarrow E^\circ_{\text{ox}} = +0.085 \text{V}$
 $\Rightarrow E^\circ_{\text{red}} = 1.229 \text{V}$

2. A student used a galvanic cell to determine the concentration of ethanol, $\text{C}_2\text{H}_5\text{OH}$, in an aqueous solution. The cell is based on the half-cell reactions represented in the table above.
- Write a balanced equation for the overall reaction that occurs in the cell.
 - Calculate E° for the overall reaction that occurs in the cell.
 - A 10.0 mL sample of $\text{C}_2\text{H}_5\text{OH}(\text{aq})$ is put into the electrochemical cell. The cell produces an average current of 0.10 amp for 20. Seconds, at which point the $\text{C}_2\text{H}_5\text{OH}(\text{aq})$ has been totally consumed.
 - Calculate the charge, in coulombs, that passed through the cell.
 - Calculate the initial $[\text{C}_2\text{H}_5\text{OH}]$ in the solution.

#2.)



$$\text{(b)} \quad E^\circ_{\text{cell}} = E^\circ_{\text{ox}} + E^\circ_{\text{red}} = 0.085 + 1.229 = \boxed{+1.314 \text{V}}$$

$$\text{(c)} \text{(i)} \quad 20. \text{ sec} \times \frac{0.10 \text{ C}}{1 \text{ s}} = \boxed{2.0 \text{ C}}$$

$$\text{(ii)} \quad 2.0 \text{ C} \times \frac{1 \text{ mol e}^-}{96,485 \text{ C}} \times \frac{1 \text{ mol C}_2\text{H}_5\text{OH}}{12 \text{ mol e}^-} = 1.7 \text{E}-6 \text{ mol C}_2\text{H}_5\text{OH}$$

$$[\text{C}_2\text{H}_5\text{OH}] = \frac{1.7 \text{E}-6 \text{ mol}}{0.0100 \text{ L}} = \boxed{1.7 \times 10^{-4} \text{ M C}_2\text{H}_5\text{OH}}$$