

Page 1

1 point

$H_2C_2O_4$

9 points

$$\ln(K_2/K_1) = -\frac{\Delta H^\circ}{R} \left(\frac{1}{T_2} - \frac{1}{T_1} \right) \Rightarrow \Delta H^\circ = \frac{-R \ln(K_2/K_1)}{(1/T_2 - 1/T_1)}$$

$$\Delta H^\circ = \frac{-(8.3145) \ln(0.555/0.666)}{(1/323.15 - 1/298.15)} = -5842 \text{ J} = \underline{\underline{-5.84 \text{ kJ}}}$$

$$\Delta G_{25}^\circ = -RT \ln K_{25} = -(8.3145)(298.15) \ln(0.666) = 1007 \text{ J}$$

$$\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ \Rightarrow \Delta S^\circ = \frac{\Delta H^\circ - \Delta G^\circ}{T} = \frac{-5842 - (1007)}{298.15} = \underline{\underline{-23.0 \text{ J/K}}}$$

$$\Delta G_{75}^\circ = \Delta H^\circ - T\Delta S^\circ = -5842 - (348.15)(-23.0) = 2165 \text{ J}$$

$$K = e^{-\Delta G^\circ/RT} = e^{-2165/(8.3145)(348.15)} = \underline{\underline{0.473}}$$

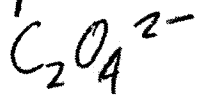
$$\ln(K_3/K_1) = -\frac{\Delta H^\circ}{R} \left(\frac{1}{T_3} - \frac{1}{T_1} \right) \Rightarrow \frac{-R \ln(K_3/K_1)}{\Delta H^\circ} + \frac{1}{T_1} = \frac{1}{T_3}$$

$$\frac{1}{T_3} = \frac{-8.3145 \ln(0.777/0.666)}{-5842} + \frac{1}{298.15} = 0.003573$$

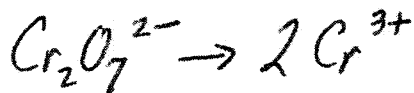
$$\Rightarrow T_3 = \underline{\underline{280 \text{ K}}}$$

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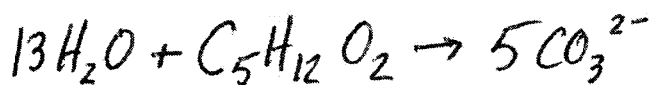
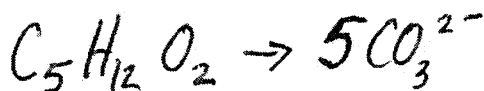
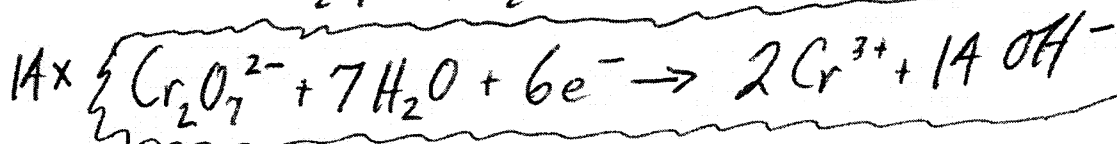
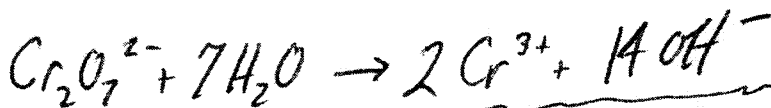
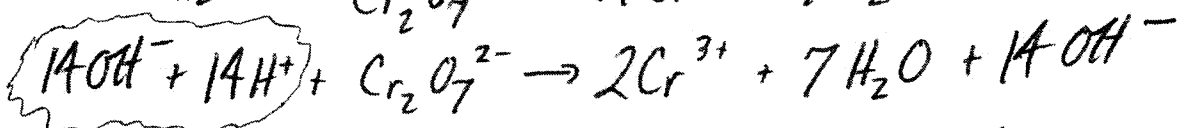
1 point



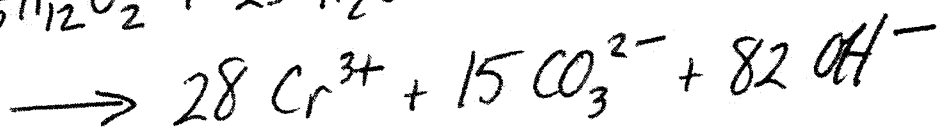
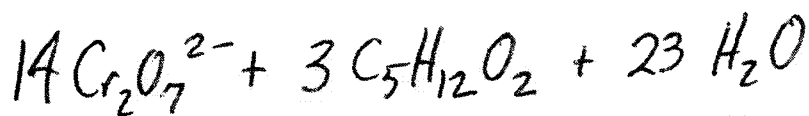
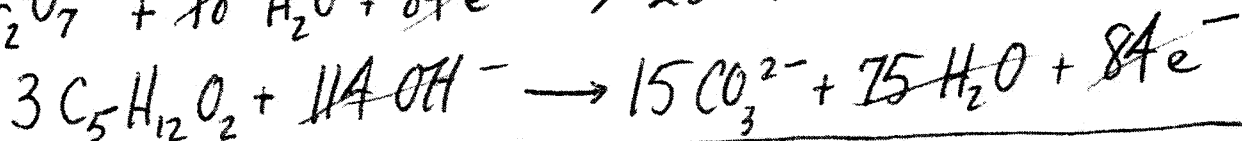
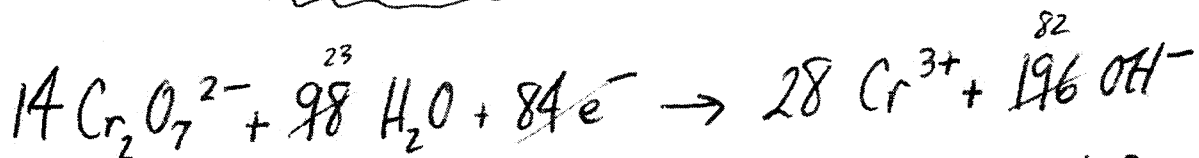
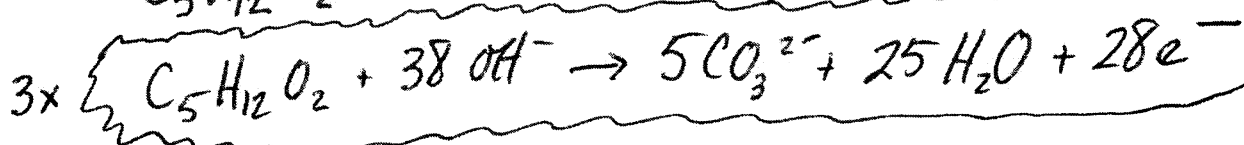
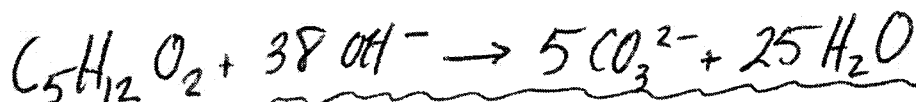
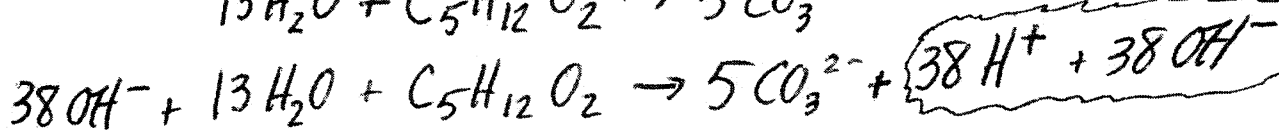
9 points



14 H₂O



38 H₂O



Page 3

1 point

négatif

2 points

$$a) C_A V_A = 2 C_B V_B \Rightarrow C_A = \frac{2 C_B V_B}{V_A} = \frac{(2)(0.222)(13.3)}{25.0} = 0.2362 \text{ M}$$

$$\left. \begin{array}{l} 0.2362 \text{ mol} \rightarrow 1000 \text{ mL} \\ x \rightarrow 25.0 \text{ mL} \end{array} \right\} x = 0.005905 \text{ mol}$$

$$\text{MM} = 2.77 \text{ g} / 0.005905 \text{ mol} = \underline{\underline{469 \text{ g/mol}}}$$

$$b) 5.0 \times 10^{-2} = \frac{x^2}{0.200} \Rightarrow x = 0.10 \quad \leftarrow \begin{array}{l} 50\% \text{ de } 0.200 \\ \Rightarrow \text{mauvaise approximation} \end{array}$$

$$5.0 \times 10^{-2} = \frac{x^2}{0.200 - x} \Rightarrow x^2 + 0.050x - 0.010 = 0$$

$$x = \frac{-0.050 + \sqrt{(0.050)^2 - (4)(1)(-0.010)}}{2} = 0.0781 = [\text{H}^+] \\ \Rightarrow \text{pH} = \underline{\underline{1.11}}$$

$$c) K_b = \frac{1.0 \times 10^{-14}}{0.050} = 2.0 \times 10^{-13}$$

$$2.0 \times 10^{-13} = \frac{[\text{OH}^-][\text{HA}]}{[\text{A}^-]} = \frac{x^2}{3.333} \Rightarrow x = 8.16 \times 10^{-7} = [\text{OH}^-]$$

$$\Rightarrow \text{pOH} = 6.09$$

$$\Rightarrow \text{pH} = \underline{\underline{7.91}}$$

Page 4

1 point
positif

5 points

$$\Delta G = \Delta G^\circ + RT \ln Q$$

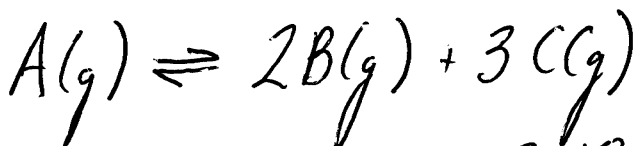
$$\Delta G^\circ = \Delta G - RT \ln Q$$

$$\Delta G^\circ = -2220 - (8.3145)(298.15) \ln \left[\frac{(0.522)^2 (0.433)^3}{(0.322)^2 (0.211)} \right]$$

$$\Delta G^\circ = -2247 \text{ J}$$

$$K = e^{-\Delta G^\circ / RT} = e^{-(-2247) / (8.3145)(298.15)} = \underline{\underline{2.48}}$$

4 points



$$i: \quad 2.00 \quad 2.00 \quad 2.00$$

$$c: \quad -x \quad +2x \quad +3x$$

$$e: \quad 2.00-x \quad 2.00+2x \quad 2.00+3x$$

$$P_T = P_A + P_B + P_C \Rightarrow 10.00 = (2.00-x) + (2.00+2x) + (2.00+3x)$$

$$10.00 = 6.00 + 4x \Rightarrow x = 1.00 \text{ atm}$$

$$P_A = 1.00 \text{ atm}$$

$$P_B = 4.00 \text{ atm}$$

$$P_C = 5.00 \text{ atm}$$

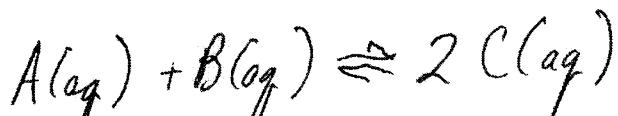
$$\Rightarrow K = \frac{P_B^2 P_C^3}{P_A} = \frac{(4.00)^2 (5.00)^3}{(1.00)} = 2000 \Rightarrow \begin{aligned} \Delta G^\circ &= -RT \ln K \\ \Delta G^\circ &= \underline{\underline{-18.8 \text{ kJ}}} \end{aligned}$$

Page 5

1 point
negatif

5 points

$$K = e^{-\Delta G^\circ/RT} = e^{-(-1770)/(8.3145)(298.15)} = 2.042$$



$$\begin{array}{l} i: 0.333 \quad 0.444 \quad 0.222 \\ c: -x \quad -x \quad +2x \\ e: 0.333-x \quad 0.444-x \quad 0.222+2x \end{array}$$

$$K = \frac{[C]^2}{[A][B]}$$

$$2.042 = \frac{(0.222+2x)^2}{(0.333-x)(0.444-x)} \Rightarrow 2.042 = \frac{4x^2 + 0.888x + 0.04928}{x^2 - 0.777x + 0.1479}$$

$$1.958x^2 + 2.4746x - 0.2527 = 0$$

$$x = \frac{-2.4746 \pm \sqrt{(2.4746)^2 - (4)(1.958)(-0.2527)}}{(2)(1.958)} = 0.0949, -1.3588$$

impossible

$$\Rightarrow [C] = 0.222 + (2)(0.0949) = \underline{\underline{0.412 M}}$$

4 points

$$3 C_A V_A = 2 C_B V_B \Rightarrow V_B = \frac{3 C_A V_A}{2 C_B} = \frac{(3)(0.333)(25.0)}{(2)(0.222)}$$

$$V_B = \underline{\underline{56.3 mL}}$$