

Page 1

1 point

H_3PO_3

9 points

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

$$\Delta H^\circ = \frac{-8.3145 \ln(1.77/2.22)}{(1/323.15 - 1/298.15)} = -7259 \text{ J} = \underline{\underline{-7.26 \text{ kJ}}}$$

$$\Delta G_{25}^\circ = -RT \ln K_{25} = -8.3145 (298.15) \ln(2.22) = -1977 \text{ J}$$

$$\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ \Rightarrow \Delta S^\circ = \frac{\Delta H^\circ - \Delta G^\circ}{T} = \frac{-7259 - (-1977)}{298.15}$$

$$\Delta S^\circ = \underline{\underline{-17.7 \text{ J/K}}}$$

$$\Delta G_{175}^\circ = \Delta H^\circ - T\Delta S^\circ = -7259 - (348.15)(-17.7) = -1097 \text{ J}$$

$$K = e^{-\Delta G^\circ/RT} = e^{-(-1097)/(8.3145)(348.15)} = \underline{\underline{1.46}}$$

$$\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ \Rightarrow T = \frac{\Delta H^\circ - \Delta G^\circ}{\Delta S^\circ} = \frac{-7259 - (-2220)}{-17.7}$$

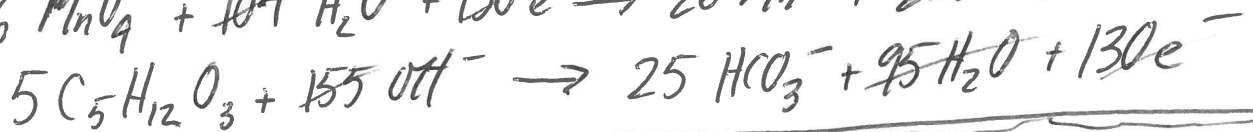
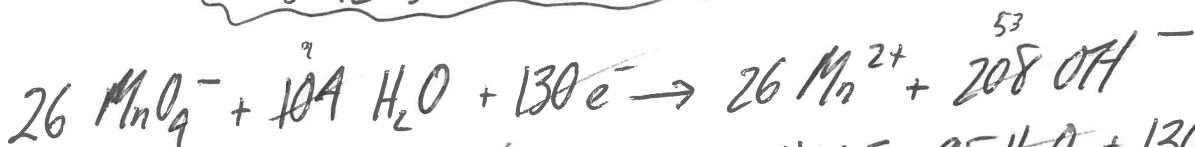
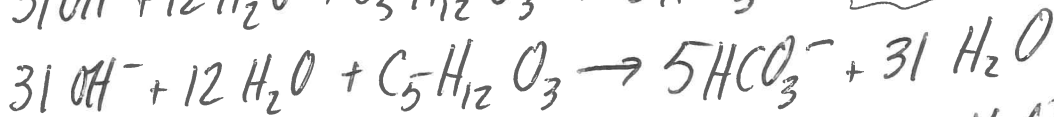
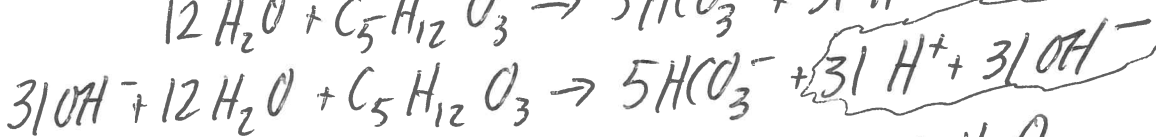
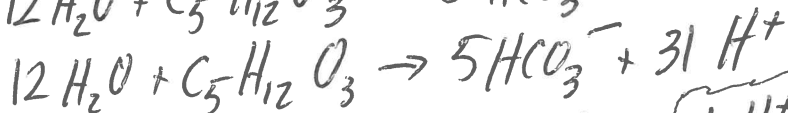
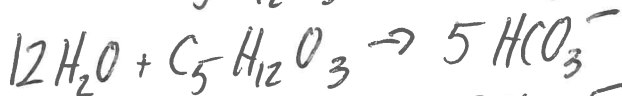
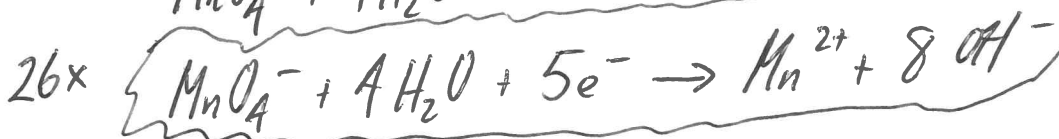
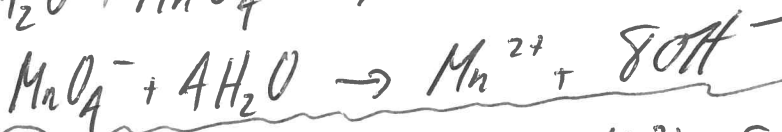
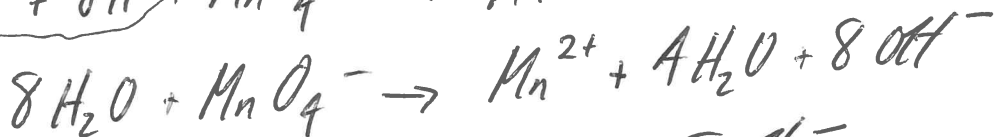
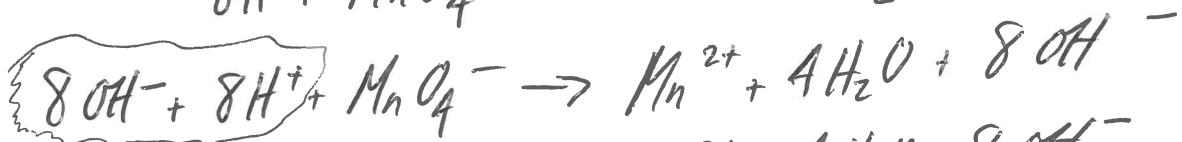
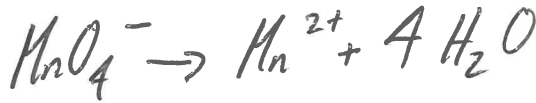
$$T = \underline{\underline{284 \text{ K}}}$$

Page 2

1 point



9 points



Page 3

1 point

positif

9 points

$$a) C_A V_A = 2 C_B V_B \Rightarrow C_A = \frac{2 C_B V_B}{V_A} = \frac{(2)(0.177)(11.1)}{(25.0)} = 0.1572 M$$

$$\left. \begin{array}{l} 0.1572 \text{ mol} \rightarrow 1000 \text{ mL} \\ x \rightarrow 25.0 \text{ mL} \end{array} \right\} x = 0.00393 \text{ mol}$$

$$MM = \frac{2.33 \text{ g}}{0.00393 \text{ mol}} = \underline{\underline{593 \text{ g/mol}}}$$

$$b) 1.0 \times 10^{-2} = \frac{x^2}{0.100} \Rightarrow x = 0.0316 \leftarrow > 5\% \Rightarrow \text{mauvaise approximation}$$

$$1.0 \times 10^{-2} = \frac{x^2}{0.100 - x} \Rightarrow x^2 + 0.010x - 0.0010 = 0$$

$$x = \frac{-0.010 + \sqrt{(0.010)^2 - (4)(1)(-0.0010)}}{(2)(1)} = 0.027 = [H^+]$$

$$\Rightarrow \text{pH} = \underline{\underline{1.57}}$$

$$c) K_b = \frac{1.0 \times 10^{-14}}{1.0 \times 10^{-2}} = 1.0 \times 10^{-12}$$

$$1.0 \times 10^{-12} = \frac{x^2}{2.222} \Rightarrow x = [OH^-] = 1.49 \times 10^{-6}$$

$$\Rightarrow \text{pOH} = 5.83 \Rightarrow \text{pH} = \underline{\underline{8.17}}$$

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1 point

positif

5 points

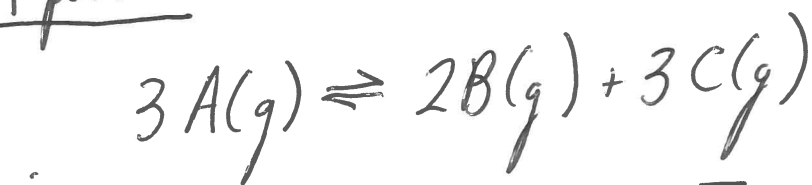
$$\Delta G = \Delta G^\circ + RT \ln Q \Rightarrow \Delta G^\circ = \Delta G - RT \ln Q$$

$$\Delta G^\circ = -3330 - (8.3145)(298.15) \ln \left[\frac{(0.611)(0.533)^3}{(0.411)(0.322)^2} \right]$$

$$\Delta G^\circ = -5252 \text{ J}$$

$$K = e^{-\Delta G^\circ/RT} = e^{-(-5252)/(8.3145)(298.15)} = \underline{\underline{8.32}}$$

4 points



i:

c:

e:

$$-3x$$

$$+2x$$

$$+3x$$

$$2x$$

$$3x$$

$$P_B = 4.00 \text{ atm} = 2x$$

$$x = 2.00 \text{ atm}$$

$$\Rightarrow P_C = 6.00 \text{ atm}$$

$$K = e^{-\Delta G^\circ/RT} = e^{-(-7770)/(8.3145)(298.15)} = 22.97$$

$$K = \frac{P_B^2 P_C^3}{P_A^3} \Rightarrow P_A = \sqrt[3]{\frac{P_B^2 P_C^3}{K}} = \sqrt[3]{\frac{(4.00)^2 (6.00)^3}{22.97}} = \underline{\underline{5.32 \text{ atm}}}$$

$$P_A(\text{initial}) = 5.32 \text{ atm} + 3x = 5.32 + 6.00 = \underline{\underline{11.32 \text{ atm}}}$$

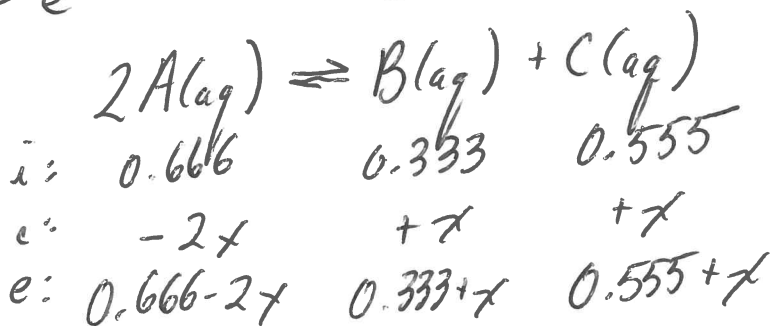
Page 5

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négatif

5 points

$$K = e^{-\Delta G^\circ / RT} = e^{-(-2770) / (8.3145)(298.15)} = 3.057$$



$$K = \frac{[B][C]}{[A]^2} \Rightarrow 3.057 = \frac{(0.333+x)(0.555+x)}{(0.666-2x)^2}$$

$$3.057 = \frac{x^2 + 0.888x + 0.1848}{4x^2 - 2.664x + 0.4436} \Rightarrow 11.228x^2 - 9.032x + 0.1171 = 0$$

impossible

$$x = \frac{9.032 \pm \sqrt{(9.032)^2 - (4)(11.228)(0.1171)}}{2(11.228)} = 0.6420, 0.1625$$

$$[A] = 0.666 - 2x = 0.666 - 2(0.1625) = \underline{\underline{0.341 M}}$$

4 points

$$n_{Al(OH)_3} = \frac{0.0888 g}{78.00 g/mol} = 0.0011385 mol \Rightarrow n_{OH^-} = 3 \times n_{Al(OH)_3}$$

$$n_{OH^-} = 0.0034155$$

$$[OH^-] = \frac{0.0034155 mol}{0.555 L} = 0.006154 M \Rightarrow pOH = 2.21$$

$$pH = \underline{\underline{11.79}}$$