

Page 1

1 point : augmenter

$$\begin{aligned} 9 \text{ points} : \Delta H^\circ &= \frac{-R \ln(K_2/K_1)}{(1/T_2 - 1/T_1)} = \frac{-8.3145 \ln(0.222/0.555)}{(1/348.15 - 1/298.15)} \\ &= -15816 \text{ J} = \underline{\underline{-15.8 \text{ kJ}}} \end{aligned}$$

$$\Delta G^\circ_{25} = -RT \ln K_{25} = -(8.3145)(298.15) \ln(0.555) = 1460 \text{ J}$$

$$\Delta G^\circ = \Delta H^\circ - T \Delta S^\circ \Rightarrow \Delta S^\circ = \frac{\Delta H^\circ - \Delta G^\circ}{T} = \frac{-15816 - (1460)}{298.15} = \underline{\underline{-57.94 \text{ J/K}}}$$

$$\Delta G^\circ_{50} = \Delta H^\circ - T \Delta S^\circ = -15816 - (323.15)(-57.94) = 2907 \text{ J}$$

$$K_{50} = e^{-\Delta G^\circ/RT} = e^{-(2907)/(8.3145)(323.15)} = \underline{\underline{0.339}}$$

\Rightarrow à pression constante, $Q = \Delta H = \underline{\underline{-15.8 \text{ kJ}}}$

$$\Delta U = \Delta H - RT \Delta n_{\text{gaz}} = -15816 - (8.3145)(298.15)(1-3)$$

$$\Delta U = -10858 \text{ J}$$

$$\begin{aligned} \Delta U = Q + W \Rightarrow W = \Delta U - Q &= -10858 - (-15816) \\ &= 4958 \text{ J} = \underline{\underline{5.0 \text{ kJ}}} \end{aligned}$$

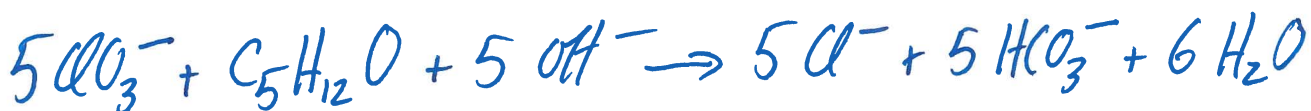
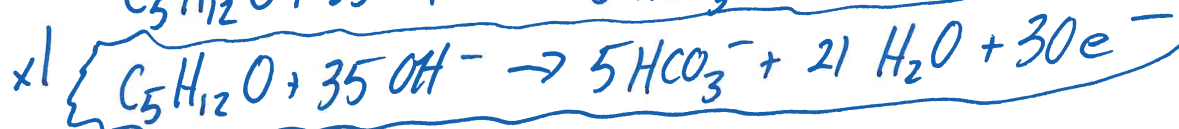
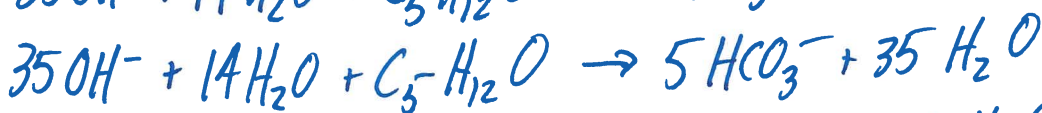
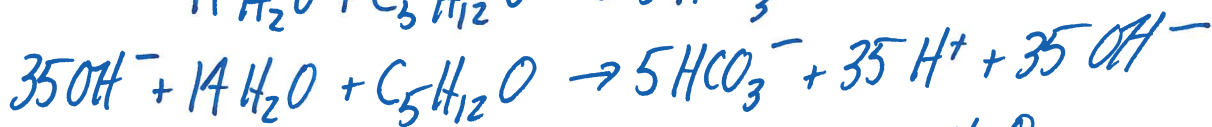
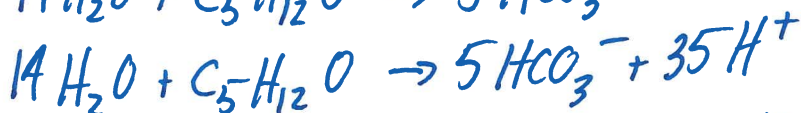
Page 2

1 point: red

9 points:



x5



Page 3

1 point : negatif

3 points : $3C_A V_A = 2C_B V_B$

$$V_A = \frac{2C_B V_B}{3C_A} = \frac{(2)(0.222)(50.0)}{(3)(0.333)} = \underline{\underline{22.2 \text{ mL}}}$$

4 points : $Q = +50.0 \text{ kJ}$ à P constante, donc $\Delta U = +50.00 \text{ kJ}$

\Rightarrow à P constante :

$\Delta U = \underline{\underline{+50.00 \text{ kJ}}}$ (ΔU ne change pas car une fonction d'état)

$$\Delta H = \Delta U + RT \Delta n_g = 50000 + (8.3145)(298.15)(2-1) \\ = \underline{\underline{52.48 \text{ kJ}}}$$

$$Q = \Delta H = \underline{\underline{52.48 \text{ kJ}}}$$

$$\Delta U = Q + W \Rightarrow W = \Delta U - Q = 50.00 - 52.48 = \underline{\underline{-2.48 \text{ kJ}}}$$

2 points : à 100°C , $\Delta G = \Delta H - T\Delta S = 0 \Rightarrow \Delta S = \frac{\Delta H}{T}$

\Rightarrow pour la condensation, $\Delta H = -40.8 \text{ kJ}$

$$\Delta S = \frac{-40800}{373.15} = \underline{\underline{-109 \text{ J/K}}}$$

Page 4

1 point: positif

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

$$\Delta G^\circ = \Delta G - RT \ln \left(\frac{[B]^3 [C]}{[A]^2} \right)$$

$$\Delta G^\circ = -8888 - (8.3145)(298.15) \ln \left[\frac{(0.333)^3 (0.555)}{(0.444)^2} \right]$$

$$\Delta G^\circ = -3276 \text{ J}$$

$$\Delta G = \Delta G^\circ + RT \ln Q = -3276 + (8.3145)(298.15) \ln \left[\frac{(0.111)^3 (0.111)}{(0.111)^2} \right]$$

$$\Delta G = -14175 \text{ J} = \underline{\underline{-14.2 \text{ kJ}}}$$

4 points:



i:	??	-
c:	-x	+2x
e:	?? -x	2x

$$P_B = 2x = 2.00$$

$$\Rightarrow x = 1.00$$

$$K = e^{-\Delta G^\circ / RT} = e^{-(-5550) / (8.3145)(298.15)} = 9.382$$

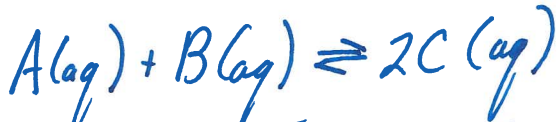
$$K = \frac{P_B^2}{P_A} \Rightarrow 9.382 = \frac{(2.00)^2}{P_A} \Rightarrow P_A = 0.426$$

$$\Rightarrow P_A(\text{initial}) = P_A(\text{final}) + x = 0.426 + 1.00 = \underline{\underline{1.43 \text{ atm}}}$$

Page 5

1 point: nul

5 points: $K = e^{-\Delta G^\circ / RT} = e^{-(-4440) / (8.3145)(298.15)} = 5.996$



i:	0.666	0.555	0.222
c:	-x	-x	+2x
e:	0.666-x	0.555-x	0.222+2x

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

$$5.996 = \frac{(0.222 + 2x)^2}{(0.666 - x)(0.555 - x)}$$

$$5.996 = \frac{4x^2 + 0.888x + 0.04928}{x^2 - 1.221x + 0.36963} \Rightarrow 1.996x^2 - 8.2091x + 2.1670 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{8.2091 \pm 7.0773}{3.992} = 3.829, 0.2835$$

↑
impossible

$$[C] = 0.222 + 2x = 0.222 + 2(0.2835) = \underline{\underline{0.789 M}}$$

4 points: $n_{PO_4^{3-}} = n_{Na_3PO_4} = C \times V = (0.222)(0.777) = 0.1725 \text{ mol}$

$$n_{Ca_3(PO_4)_2} = \frac{n_{PO_4^{3-}}}{2} = \frac{0.1725}{2} = 0.08625 \text{ mol}$$

$$\text{masse } (Ca_3(PO_4)_2) = (0.08625 \text{ mol})(310.18 \text{ g/mol}) = \underline{\underline{26.8 g}}$$