Answer on Question #79400 – Chemistry – General Chemistry

Part A: $K_p = 2.7\times10^{-4}$
At 25°C the reaction from Part A has a composition as shown in the table below.
Substance Pressure (atm):
$C_2H_2(g)$ 4.35
$H_2(g)$ 3.75
$C_2H_6(g)$ 1.25×10^{-2}
What is the free energy change, ΔG, in kilojoules for the reaction under these conditions?

Solution:

$2H_2 + C_2H_2 \rightarrow C_2H_6$

$$K_p = \frac{[C_2H_6]_p}{[H_2]^2[C_2H_2]} = \frac{1.25\times10^{-2}}{(3.75)^2 4.35} = 2.04\times10^{-4}$$

$\Delta G = -RT(\ln K_p) = -(8.314\ J/mol\cdot K) \times (298\ K) \times \ln(2.04\times10^{-4})$
$\Delta G = 21048\ J/mol = 21.05\ kJ/mol$