Le Châtelier’s Principle

Consider the chemical equation:

\[ N_2 (g) + 3 \text{H}_2 (g) \rightleftharpoons 2 \text{NH}_3 (g) + 46.1 \frac{\text{kJ}}{\text{mol}} \]

1. Indicate which direction the equilibrium would shift as a result of each of the following:

(a) Adding \( N_2 \)

(b) Removing \( \text{NH}_3 \)

(c) Removing \( \text{H}_2 \)

(d) Decreasing the temperature

(e) Increasing the pressure

2. Write the equilibrium expression for the above reaction.
3. The value of $K_{eq}$ for this reaction is $5.34 \times 10^6$ at 25°C. If the reaction is at equilibrium at 25°C, the concentration of H$_2$ is 0.050 $M$ and the concentration of N$_2$ is 0.025 $M$, what is the concentration of NH$_3$?

4. If the concentration of H$_2$ is decreased to 0.040 $M$, and the concentration of N$_2$ and the temperature remain unchanged, what is the new equilibrium concentration of NH$_3$? Is this consistent with the prediction made by Le Châtelier’s Principle in question #1c above?