3. (28 points) Consider the following exothermic reaction in equilibrium

$$\text{AgNO}_3(\text{aq}) + \text{NaCl}(\text{aq}) \rightleftharpoons \text{AgCl}(\text{s}) + \text{NaNO}_3(\text{aq})$$

A. Le Chatlier's Principle: If the action shifts the equilibrium toward the reactants (left) write left. If the action shifts the equilibrium toward the products (right) write right. If the action has no effect on the equilibrium, write none.

- right Adding NaCl to the reaction mixture.
- right Adding AgNO$_3$ to the reaction mixture.
- none Adding AgCl(s) to the reaction mixture.
- left Increasing the temperature of the mixture.
- none Adding a KMnO$_4$ to the reaction mixture which is a catalyst.
- none Removing AgCl(s) from the reaction mixture.

B. Consider the following reaction:

$$\text{CO}(\text{g}) + \text{H}_2\text{O}(\text{g}) \rightleftharpoons \text{CO}_2(\text{g}) + \text{H}_2(\text{g}) \quad K_p = 1.00$$

A mixture with the following partial pressures is produced: CO (55 torr), H$_2$O (110 torr), CO$_2$ (150 torr), H$_2$ (30 torr).

Will this reaction proceed to the left, right, or is it in equilibrium. Please justify your answer via a calculation.

$$Q = \frac{(150 \text{ torr}) (30 \text{ torr})}{(55 \text{ torr}) (110 \text{ torr})} = 0.74$$

$$Q < K_p \Rightarrow \text{rxn goes to right}$$