Graphs and Le Chatelier's Principle

1) Change in concentration
   When a substance is added or removed from a system, it appears as a spike on a concentration vs time graph.
Example:

\[ \text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2 \text{HI}(\text{g}) \]

The reaction favors the products. On the graph, show how the equilibrium is affected by the addition of iodine.

2) Change in volume of a gas phase system (C=n/V)
-if the volume of a container is increased, then the concentration of all substances is initially decreased (and vice versa)

Example

\[ 2 \text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2 \text{SO}_3(\text{g}) \]

The reaction favors the products. On the graph, show how the equilibrium is if the volume of the container is decreased.
At $200^\circ C$, the equilibrium system represented by the following equation and diagram was established.

\[ \text{PCl}_3(g) + \text{energy} \rightleftharpoons \text{PCl}_3(g) + \text{Cl}_2(g) \]

**Equilibrium System**

Does the equilibrium favor the reactants or the products?

At what time is equilibrium first established in this system?

5 minutes

What is the value of $K_c$?

\[
K_c = \frac{[\text{Cl}_2][\text{PCl}_3]}{[\text{PCl}_5]} = \frac{0.00 \text{ mol/L} \cdot 1.5 \text{ mol/L}}{0.50 \text{ mol/L}} = 9.0
\]

Describe the stress that could explain the change in the graph at 14.0 minutes

**temp change:**
**temp decreased:**
**$K_c$ decreases**

\[ \text{H}_2 + \text{I}_2 \rightleftharpoons 2 \text{HI} \]

**Concentration (mol/L)**

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**Time (minutes)**