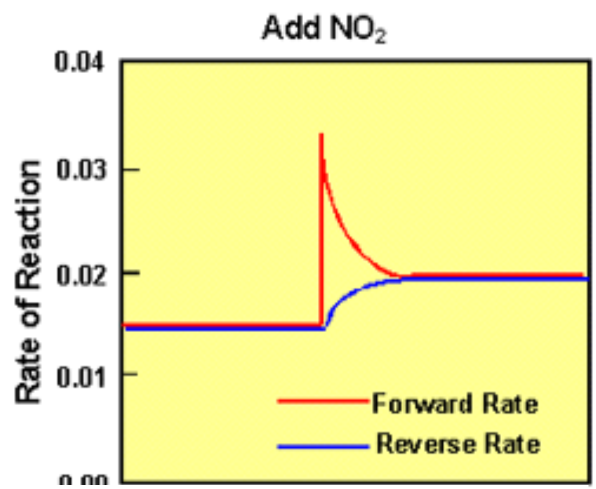
Interpreting Graphs

Graphs of RATE of Reaction vs Time

The reaction:

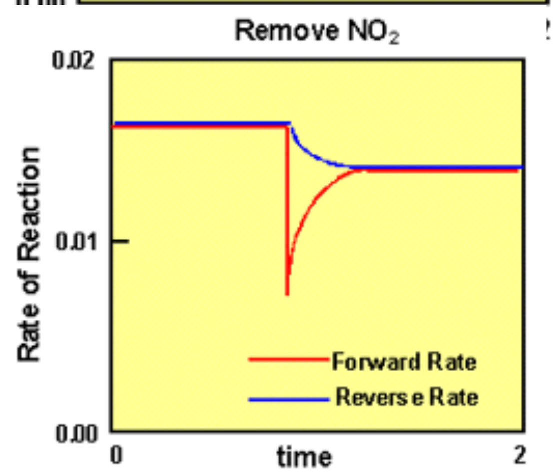
$$2\ NO_2(g) \leftarrow\rightarrow N_2O_4(g)\ \Delta H = -58.0\ kJ/mol\ N_2O_4$$



Initially the reaction is at equilibrium - both the forward and the reverse rates are equal.

At the instant when more reactant NO_2 is added, the forward rate increases. As the reactant is consumed in the reaction, more products are formed and eventually it equalizes. The product rate is faster than the initial rate before the addition.

If we *remove* some NO_2 from the system the following graph results.

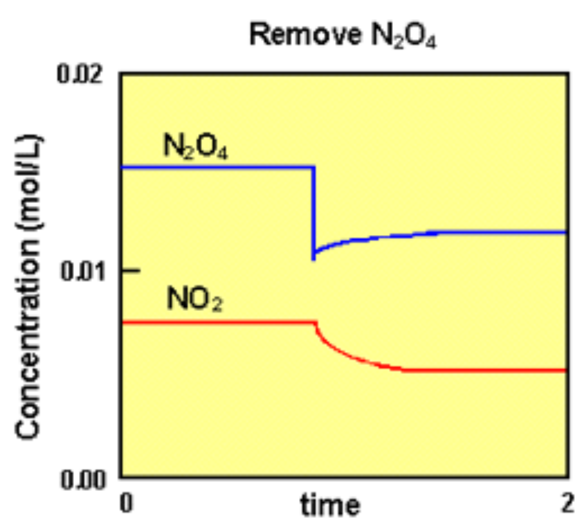


Initially the reaction is at equilibrium - both the forward and reverse rates are equal. At the instant when reactant NO_2 is removed, the forward rate decreases (because we have less reactants to react). As the equilibrium shifts to the left, there forward increases from the drop of removing the reactants and increases to an equilibrium. But now the rate of the forward is lower than the initial.

Graphs of CONCENTRATION vs Time

The reaction:

$$2\ NO_2(g) \leftarrow\rightarrow N_2O_4(g)\ \Delta H = -58.0\ kJ/mol\ N_2O_4$$



At the instant when product N_2O_4 is added, the concentration of N_2O_4 goes up abruptly. Almost immediately, the concentration begins to decrease because the reverse rate has increased, relative to the forward rate.

The concentration of NO_2 begins to increase after the addition of the product due to the increased reverse rate.

Eventually, as in the previous graphs a new equilibrium position is reached.

Similarly, at the instant N_2O_4 is removed, the reverse rate goes down. As a result, the forward rate is larger than the reverse rate and the concentration of the reactant begins to decrease as the product is replaced. Eventually the system adjusts and a new equilibirum position is reached, but the value of K remains the same.