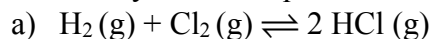


Questions taken from textbook pgs. 568 & 586

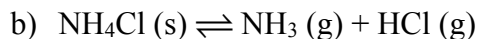
1) Name three ways that the chemical equilibrium can be disturbed.

Changing the concentration of a reactant or product; changing the volume/pressure (for gaseous systems) [note: diluting an aqueous system has the same effect]; changing temperature.

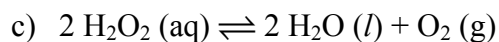
2) Predict the effect that decreasing the pressure (increasing volume) would have on each of the following reaction systems at equilibrium:



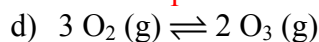
2 moles 2 moles
No changes since equal moles of gas.



0 moles 2 moles
Shifts right toward more moles of gas to increase pressure



0 moles 1 mole
Shifts right toward more moles of gas



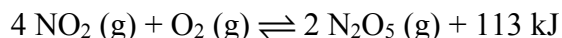
3 moles 2 moles
Shifts left toward more moles

3) When solid carbon reacts with oxygen gas to form carbon dioxide, 393.51 kJ of heat are released. Does this reaction become more or less favorable as the temperature decreases? Explain.



As temperature decreases, the reaction "shifts" to the right to replenish lost heat (K_{eq} increases), so the reaction becomes *more* favorable as T increases.

4) Predict whether each of the following stresses to the indicated reaction in equilibrium will favor the forward or reverse reaction. How will $[\text{N}_2\text{O}_5]$ and K_{eq} be affected?



a) addition of O_2

Shifts right, $[\text{N}_2\text{O}_5] \uparrow$, K_{eq} unchanged

b) removal of N_2O_5

Shifts right, $[\text{N}_2\text{O}_5] \uparrow$ from amount after removal but $<$ original, K_{eq} unchanged

c) increased pressure

Shifts right (to fewer moles of gas), $[\text{N}_2\text{O}_5] \uparrow$, K_{eq} unchanged

d) decreased temperature

Shifts right, $[\text{N}_2\text{O}_5] \uparrow$, K_{eq} increases

e) removal of NO_2

Shifts left, $[\text{N}_2\text{O}_5] \downarrow$, K_{eq} unchanged

f) decreased pressure

Shifts left (to more moles of gas), $[\text{N}_2\text{O}_5] \downarrow$, K_{eq} unchanged

g) addition of a catalyst

No change in anything

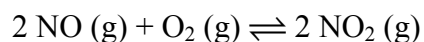
h) increased temperature

Shifts left, $[\text{N}_2\text{O}_5] \downarrow$, K_{eq} decreases

i) decreased system volume

Shifts right (to fewer moles of gas, same as c), $[\text{N}_2\text{O}_5] \uparrow$, K_{eq} unchanged

- 5) For the following reaction, would an increase or a decrease in pressure favor the forward reaction?

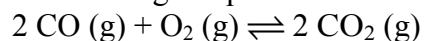


Since there are fewer moles of gas in the products, increasing the pressure causes the system to respond by making less gas, favoring the products and forward direction.

- 6) Explain the effect of a catalyst on an equilibrium system.

A catalyst will increase the rates of both the forward and reverse reactions by the same factor, so the equilibrium position is unchanged but achieved faster.

- 7) What relative pressure (high or low) would result in production of the maximum level of CO₂ according to the following? Explain.



Since there are fewer moles of gas in the products, the forward direction will be favored by increasing the pressure so the system responds by moving to the side with fewer moles of gas.