Equilibrium III   Chil7 # 31–41, odd

31. For an equilibrium involving gaseous substances, decreasing the volume will, in general, shift the equilibrium ~~toward products~~ in the direction that results in the fewest number of moles of gas in the reaction vessel.

$$aA_{(g)} + bB_{(g)} \rightleftharpoons cC_{(g)} + dD_{(g)}$$

If $(a+b) > (c+d)$, decreasing V shifts equilibrium to the right.

If $(a+b) < (c+d)$, decreasing V shifts equilibrium to the left.

33. $4NH_{3(g)} + 5O_{2(g)} \rightleftharpoons 4NO_{(g)} + 6H_2O_{(g)}$

Starting at equilibrium...

a) Increasing P_{O_2} will shift reaction to the right, producing more NO + H_2O

b) Decreasing $[H_2O]$ will shift reaction to the right, ~~prod~~ consuming NH_3 + O_2

c) Decreasing P_{NH_3} will shift reaction to the left, consuming NO + H_2O

35. $CH_{4(g)} + 2O_{2(g)} \rightleftharpoons CO_{2(g)} + 2H_2O_{(l)}$

a) $\downarrow H_2O_{(l)} \Rightarrow$ no effect

b) $\uparrow P_{CO_2} \Rightarrow$ shift left

c) $\downarrow V \Rightarrow$ shift right

d) $\uparrow P_{O_2} \Rightarrow$ shift right

37. $(NH_4)_2CO_{3(s)} \rightleftharpoons 2NH_{3(g)} + CO_{2(g)} + H_2O_{(g)}$; $\Delta H_{rxn} > 0$

Since reaction is endothermic, can think of heat as a "reactant".

By decreasing the temperature of the equilibrium, you are removing heat; i.e., removing a reactant. To counteract this, the reaction equilibrium will **shift left** to replace the reactant.

39. $C_2H_2\,(g) + 2Br_2\,(g) \leftrightharpoons C_2H_2Br_4\,(g)$: $\Delta H_{rxn} < 0$

$\uparrow T$ => shift left => shift toward reactants

41. $6\,CO_2\,(g) + 6H_2O\,(g) \leftrightharpoons C_6H_{12}O_6\,(s) + 6O_2\,(g)$ $\Delta H_{rxn} > 0$ (light energy is <u>absorbed</u>)

$\uparrow T$ => shift right => ~~fa~~vors production of $C_6H_{12}O_6\,(s)$.