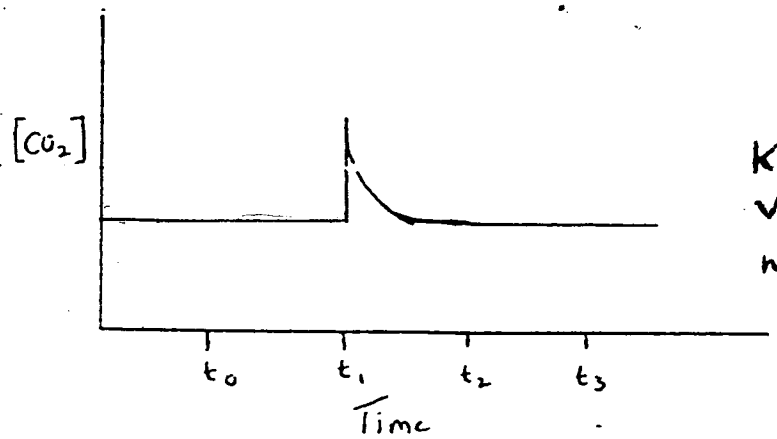
Equilibrium #8 #1-5

1.



$K_{eq} = [CO_2]$

↓ P ↑ . [change]

no effect on K_{eq}, so $[CO_2]$ same

2. $CO_{(g)} + H_2O_{(g)} \longleftrightarrow CO_{2(g)} + H_{2(g)}$

$$K_{eq} = \frac{[CO_2][H_2]}{[CO][H_2O]} = 16$$

$$\frac{(0.90+x)^2}{(0.30-x)^2} = 16 \quad \sqrt{\text{ both sides}}$$

	CO	H_2O	CO_2	H_2
I	0.30	0.30	0.90	0.90
C	−x	−x	+x	+x
E	0.30−x	0.30−x	0.90+x	0.90+x

$x = 0.060$ $\quad [CO_2]_{Eq} = 0.90 + 0.060 = \underline{\underline{0.96\ M}}$

3. When the temperature is increased K_{eq} will decrease. Increasing the temperature favors the endothermic, or reverse, reaction which decreases the [products] and increases [reactants] so K_{eq} is lower.

4. a) $[CH_3OH]$ increases when volume is decreased at constant temperature the eqm shifts to favor the side with fewer gas particles.

b) [CO] is unchanged when a catalyst is added, as adding a catalyst affects the forward and reverse rates equally and does not change the position of the equilibrium.

5. $Fe^{3+}_{(aq)} + SCN^-_{(aq)} \longleftrightarrow FeSCN^{2+}_{(aq)}$

$$K_{eq} = \frac{[FeSCN^{2+}]}{[Fe^{3+}][SCN^-]}$$

	Fe^{3+}	SCN^-	$FeSCN^{2+}$
I	2.8×10^{-3}	1.00	0
C	-2.8×10^{-4}	-2.8×10^{-4}	$+2.8\times10^{-4}$
E	2.32×10^{-3}	1.00	2.8×10^{-4}

$$K_{eq} = \frac{2.8\times10^{-4}}{(2.32\times10^{-3})(1.00)} = \underline{\underline{0.121}} = \underline{\underline{0.12}}$$

Equilibrium #8 #6-10 Keq:

6. $2NO_{(g)} + Br_{2(g)} \longleftrightarrow 2NOBr_{(g)}$

	NO	Br_2	NOBr
I	0	0	X
C	+0.0800	+0.0400	−0.0800
E	0.0800	0.0400	X − 0.080

$$K_{eq} = \frac{[NOBr]^2}{[NO]^2[Br_2]} = 1.0 \times 10^2$$

$$K_{eq} = \frac{(X - 0.0800)^2}{(0.0800)^2(0.0400)} = 1.0 \times 10^2$$

$X = 0.24\,M$ #mols NOBr $= 0.24\,M \times 2.00\,L = \underline{\underline{0.48 \text{ moles}}}$

7. If oxygen is added, there is a net increase in O_2, NO and H_2O. there is a net decrease in N_2H_4.

8. $H_{2(g)} + I_{2(g)} \longleftrightarrow 2HI_{(g)}$

	H_2	I_2	HI
I	0.200	0.200	0
C	−0.160	−0.160	+0.320
E	0.040	0.040	0.320

$$K_{eq} = \frac{[HI]^2}{[H_2][I_2]}$$

$$K_{eq} = \frac{(0.320)^2}{(0.040)^2} = \underline{\underline{64}}$$

9. $2\,CH_{4(g)} \longleftrightarrow C_2H_{2(g)} + 3H_{2(g)}$

	CH_4	C_2H_2	H_2
I	0.180	0	0
C	−0.160	+0.0800	+0.240
E	0.020	0.0800	0.240

$$K_{eq} = \frac{[C_2H_2][H_2]^3}{[CH_4]^2}$$

$$K_{eq} = \frac{(0.0800)(0.240)^3}{(0.020)^2} = \underline{\underline{2.76}}$$

10. $2NO_{(g)} + O_{2(g)} \longleftrightarrow 2NO_{2(g)}$

(a) $$K_{eq} = \frac{[NO_2]^2}{[NO]^2[O_2]}$$

(b) K_{eq} is greater than 1 ∴ when $[O_2] = 1.0\,M$ the value of $[NO_2]^2$ is greater than the value of $[NO]^2$ ∴ $[NO_2] > [NO]$

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11. $2HI_{(g)} \longleftrightarrow H_{2(g)} + I_{2(g)}$ $K_{eq} = 81.0$

	$2HI_{(g)}$	$H_{2(g)}$	$I_{2(g)}$
I	4.00 M	0	0
C	$-2x$	$+x$	$+x$
E	$4.00 - 2x$	x	x

$$K_{eq} = \frac{[H_2][I_2]}{[HI]^2}$$

$$81.0 = \frac{x^2}{(4.00-2x)^2} \qquad x = 1.89$$

$[HI] = 4.00 - 2(1.89) = 0.21\ M$

12. When HCl is added the H^+ ion from the HCl reacts with the OH^- in the equilibrium to produce water. The $[OH^-]$ decreases which shifts the equilibrium to the products to make more OH^- and more $Cr_2O_7^{2-}$ which is orange.

13. $2NO_{(g)} + O_{2(g)} \longleftrightarrow 2NO_{2(g)}$

$$[NO] = \frac{0.044\ mol}{2.00\ L} = 0.022\ M$$

$$[O_2] = \frac{0.100\ mol}{2.00\ L} = 0.050\ M$$

$$[NO_2] = \frac{7.88\ mol}{2.00\ L} = 3.94\ M$$

$$K_{eq} = \frac{[NO_2]^2}{[NO]^2[O_2]}$$

$$K_{eq} = \frac{(3.94)^2}{(0.022)^2(0.050)} = 6.4 \times 10^5$$