

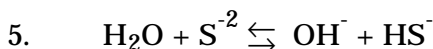
$$1. K_c = \frac{[N_2][H_2]^3}{[NH_3]^2} = \frac{(0.0100)(0.300)^3}{(0.0040)^2} = 16.9$$

$$K_p = K_c \times [RT]^n = (16.9) \times [(0.08206)(1018)]^2 = 1.18 \times 10^5$$

$$2. Q_c = \frac{[CO_2][H_2]}{[CO][H_2O]} = \frac{(0.800)(0.350)}{(0.500)(0.500)} = 1.12 < K_c, \text{ so reaction will go } \rightarrow$$

3.	$SO_3(g) + NO(g) \rightleftharpoons SO_2(g) + NO_2(g)$	$K_c = 0.50$	$K_c = 0.50 = \frac{[SO_2][NO_2]}{[SO_3][NO]} = \frac{(x)(x)}{(0.150-x)(0.150-x)}$
initial	0.150    0.150	0    0	
change	-x    -x	+x    +x	
eq. con	0.150-x    0.150-x	+x    +x	$0.707 = \frac{x}{0.150-x} \quad x = 0.106 - 0.707x$
eq. con	0.088    0.088	0.062    0.062	$1.707x = 0.106; x = 0.062$

4. a) the temperature is increased?  $\leftarrow$   
 b)  $Cl_2$  is added?  $\rightarrow$   
 c) the pressure is increased by decreasing the volume of the container?  $\rightarrow$   
 d)  $SO$  is removed?  $\leftarrow$   
 e) the pressure is increased by adding argon gas? no change



$H_2O$  is the acid.  $OH^-$  is its conjugate base     $S^{-2}$  is the base,  $HS^-$  is its conjugate acid

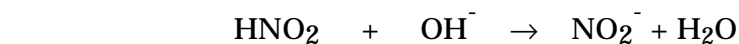
$$6. [H_3O^+] = 0.310 \text{ M}, \text{ pH} = -\log(0.310) = 0.509 \quad \text{pOH} = 14 - \text{pH} = 13.491$$

7.	$HCN + H_2O \rightleftharpoons H_3O^+ + CN^-$	$K_a = 7.2 \times 10^{-10}$	$K_a = 7.2 \times 10^{-10} = \frac{[H_3O^+][CN^-]}{[HCN]}$
i	1.25	0    0	
C	-x	x    x	
e	1.25 - x	x    x	$7.2 \times 10^{-10} = \frac{x^2}{(1.25 - x) \cdot 1.25}$
			$x = 3.0 \times 10^{-5} = [H_3O^+]$
			$\text{pH} = -\log(3.0 \times 10^{-5}) = 4.52$

8.	$K_b(OCl^-) = \frac{K_w}{K_a} = \frac{10^{-14}}{3.0 \times 10^{-8}} = 3.3 \times 10^{-7}$	$K_b = 3.3 \times 10^{-8} = \frac{[HOCl][OH^-]}{[C_2H_3O_2^-]}$	
	$OCl^- + H_2O \rightleftharpoons HOCl + OH^-$		
i	0.150	0    0	
C	-x	x    x	
e	0.150 - x	x    x	$3.3 \times 10^{-8} = \frac{x^2}{(0.150 - x) \cdot 0.150}$
			$x = [OH^-] = 2.2 \times 10^{-4}$
			$\text{pOH} = 3.65 \quad \text{pH} = 10.35$

$$9. \text{pH} = \text{pKa} + \log \frac{[\text{base}]}{[\text{acid}]} = -\log(3.5 \times 10^{-4}) + \log \frac{0.350}{0.450} = 3.347$$

$$10. (25.00 \text{ mL})(0.200 \text{ M HNO}_2) = 5.00 \text{ mmol HNO}_2 \quad (10.00 \text{ mL})(0.300 \text{ M NaOH}) = 3.00 \text{ mmol NaOH}$$



s, mmol	5.00	3.00	0
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R, mmol	-3.00	-3.00	+3.00
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f, mmol	2.00	0	3.00	soln is a buffer, use Henderson-Hasselbalch eq
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$$\text{pH} = \text{pKa} + \log \frac{[\text{base}]}{[\text{acid}]} = -\log(4.6 \times 10^{-4}) + \log \frac{(3.00)}{(2.00)} = 3.513$$