Chemistry 2212 Sample Quiz 3 Answers

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

3.

	$SO_{3(g)}$ +	$NO_{(g)}$ ⇆	$SO_{2(g)}$ +	$NO_{2(g)}$	K_c =0.50
initial	0.150	0.150	0	0	
change	-x	-x	+x	+x	
eq. con	0.150-x	0.150-x	+x	+x	
eq. con	0.088	0.088	0.062	0.062	

$K_c = 0.50 = \frac{[SO_2][NO_2]}{[SO_3][NO]} = \frac{(x)(x)}{(0.150-x)(0.150-x)}$

$0.707 = \frac{x}{0.150-x}$ $x = 0.106 - 0.707x$

$1.707x = 0..106$; $x = 0.062$

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

5. $H_2O + S^{-2} \leftrightarrows OH^- + HS^-$

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

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

7. $HCN + H_2O \leftrightarrows H_3O^+ + CN^-$ $K_a = 7.2 \times 10^{-10}$

i	1.25	0	0
C	-x	x	x
e	1.25 - x	x	x

$K_a = 7.2 \times 10^{-10} = \frac{[H_3O^+][CN^-]}{[HCN]}$

$7.2 \times 10^{-10} = \frac{x^2}{(1.25 - x)}$ $\frac{x^2}{1.25}$

$x = 3.0 \times 10^{-5} = [H_3O^+]$

pH = -log(3.0×10^{-5}) = 4.52

8. $K_b(OCl^-) = \frac{K_w}{K_a} = \frac{10^{-14}}{3.0 \times 10^{-8}} = 3.3 \times 10^{-7}$

$OCl^- + H_2O \leftrightarrows HOCl + OH^-$

i	0.150	0	0
C	-x	x	x
e	0.150 - x	x	x

$K_b = 3.3 \times 10^{-8} = \frac{[HOCl][OH^-]}{[C_2H_3O_2^-]}$

$3.3 \times 10^{-8} = \frac{x^2}{(0.150 - x)}$ $\frac{x^2}{0.150}$

$x = [OH^-] = 2.2 \times 10^{-4}$

pOH = 3.65 pH = 10.35

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

10. (25.00 mL)(0.200 M HNO_2) = 5.00 mmol HNO_2 (10.00 mL)(0.300 M NaOH) = 3.00 mmol NaOH

	HNO_2 +	OH^- →	NO_2^- + H_2O
s, mmol	5.00	3.00	0
R, mmol	-3.00	-3.00	+3.00
f, mmol	2.00	0	3.00

soln is a buffer, use Henderson-Hasselbalch eq

$pH = pKa + \log \frac{[base]}{[acid]} = -\log(4.6 \times 10^{-4}) + \log \frac{(3.00)}{(2.00)} = 3.513$