

## Chemical Equilibrium Review

1. D      2. A      3. D      4. C      5. B

6. - temperature would remain constant  
 - heat required for forward reaction would equal the heat released by the reverse reaction

7.

	$3H_2$	+	$N_2$	$\rightleftharpoons$	$2NH_3$
I	x				0
C	-2.25		-0.75		+1.5
E	3.0		2.0		1.5

$$x - 2.25 = 3.0$$

$$[H_2] = 5.25 \text{ mol/L}$$

it is a 1 L container

$$\therefore \underline{5.25 \text{ mol}}$$

8,9 I - increase in [B]  
 II - increase in temperature  
 III - increase in [C]  
 IV - decrease in temperature

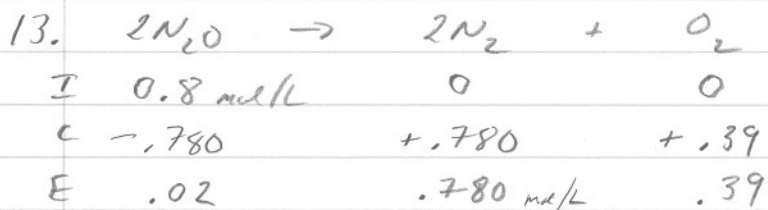
$$10. K_c = \frac{[B][C]^2}{[A]^3} = \frac{(2)(4)^2}{(3)^3} = \underline{1.19}$$



$$12. K_{eq} = \frac{[NaHSO_4][HI]}{[NaI][H_2SO_4]}$$

$$7.3 \times 10^{-4} = \frac{(3.2 \times 10^{-2} \text{ mol/L})(4.6 \times 10^{-4} \text{ mol/L})}{(x)(2.1 \times 10^{-1} \text{ mol/L})}$$

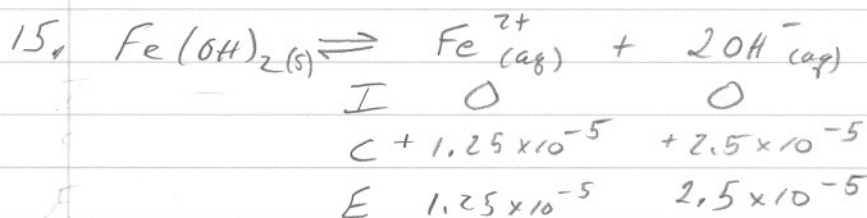
$$[NaI] = 10.4 \text{ mol/L}$$



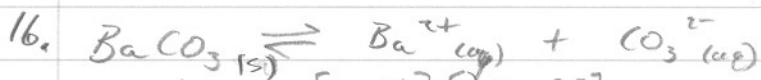
$$K_c = \frac{[N_2]^2 [O_2]}{[N_2O]^2} = \frac{(.780)^2 (.39)}{(.02)^2} = \underline{593}$$

14. (a) - increase the volume of the container  
 - increase the temperature

(b) - it will allow the system to reach equilibrium faster



$$K_{sp} = [Fe^{2+}][OH^-]^2 = (1.25 \times 10^{-5})(2.5 \times 10^{-5})^2 = \underline{7.81 \times 10^{-15}}$$



$$K_{sp} = [Ba^{2+}][CO_3^{2-}]$$

$$5.1 \times 10^{-9} = (x)(x)$$

$$x = 7.14 \times 10^{-5} \text{ mol/L}$$

$$1 \text{ mol } BaCO_3 = (137.3) + (12) + 3(16) = 197.3 \text{ g}$$

$$[BaCO_3] = \frac{\text{mol}}{L}$$

$$7.14 \times 10^{-5} = \frac{x}{1.2L} \quad x = 8.57 \times 10^{-5} \text{ mol}$$

$$\text{mol} = \frac{\text{mass}}{\text{Molar mass}}$$

$$8.57 \times 10^{-5} \text{ mol} = \frac{x}{197.3 \text{ g}}$$

$$\underline{x = 0.017 \text{ g}}$$



$$K_{sp} = [\text{Bi}^{3+}][\text{I}^{-}]^3$$

18. (a) insoluble (b) insoluble (c) insoluble



$$[\text{MgCl}_2] = \frac{\text{mol}}{\text{L}}$$

$$.2 = \frac{x}{.015\text{L}}$$

$$x = 0.003 \text{ mol}$$

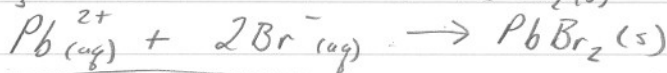
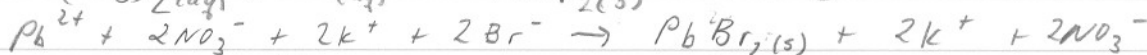
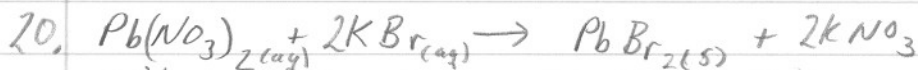
$$[\text{KOH}] = \frac{\text{mol}}{\text{L}}$$

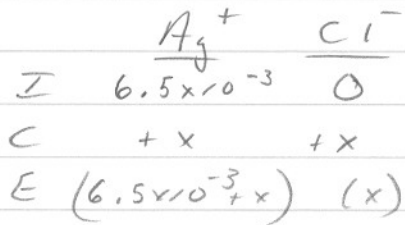
$$.18 = \frac{x}{.025\text{L}}$$

$$x = 0.0045 \text{ mol}$$

- If the reaction goes to completion, either all of the  $\text{MgCl}_2$  or  $\text{KOH}$  will be used up.
- we need twice as much  $\text{KOH}$  as  $\text{MgCl}_2$
- If we use  $0.003 \text{ mol}$  of  $\text{MgCl}_2$ , we need  $2(.003) = .006 \text{ mol}$  of  $\text{KOH}$ , we don't have that much, so that doesn't happen
- If we use  $0.0045 \text{ mol}$  of  $\text{KOH}$ , we need  $\frac{(0.0045)}{2} = 0.00225 \text{ mol}$  of  $\text{MgCl}_2$ , this works.
- if we use  $1 \text{ mol}$  of  $\text{MgCl}_2$ ,  $1 \text{ mol}$  of  $\text{Mg}(\text{OH})_2$  is produced.

Therefore, since we use  $0.00225 \text{ mol}$  of  $\text{MgCl}_2$  we produce  $0.00225 \text{ mol}$  of  $\text{Mg}(\text{OH})_2$





$$K_{sp} = [\text{Ag}^+][\text{Cl}^-]$$

$$1.6 \times 10^{-10} = (6.5 \times 10^{-3} + x)(x)$$

↑ ignore this x

$$1.6 \times 10^{-10} = (6.5 \times 10^{-3})x$$

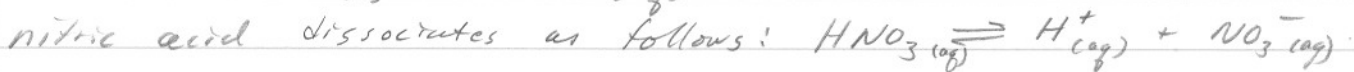
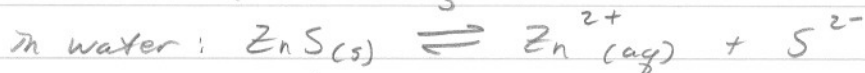
$$x = 2.46 \times 10^{-8} \text{ mol/L}$$

$$1 \text{ mol AgCl} = (107.9)(35.45) = 143.35 \text{ g}$$

$$2.46 \times 10^{-8} \text{ mol} (143.35 \text{ g}) = 3.53 \times 10^{-6} \text{ g}$$

Solubility of AgCl in this situation is  $3.53 \times 10^{-6} \text{ g/L}$

22. Nitric Acid =  $\text{HNO}_3$



The  $\text{H}^+$  from the nitric acid will combine with the  $\text{S}^{2-}$  from the zinc sulfide causing that reaction to go to the right, causing more ZnS to be dissolved.