Solution Stoichiometry

300 mL of 0.2 M KOH is poured into a beaker of 500mL of 0.1 M HCl.

Write the equation, determine the limiting reactant.
Determine the concentration of each ion after the reaction.

neutralization
solubility

Write the equation. Make an ISE table.

$1KOH_{(aq)} + 1HCl_{(aq)} \rightarrow HOH_{(l)} + KCl_{(aq)}$ (LR: HCl)

	KOH	HCl	HOH	KCl
I	0.06	0.05		
S	-0.05	-0.05	+0.05	+0.05
E	0.01 (excess K^+ OH^-)	0	0.05 (not ion (l))	0.05 (K^+ Cl^-)

Determine moles of reactants and limiting reactant. Fill out ISE.

$M = \frac{mol}{L}$

KOH: $0.2M = \frac{X}{0.3}$ mol, $X = 0.06$ mol

HCl: $0.1M = \frac{X \text{ mol}}{0.5L}$, $X = 0.05$ mol

$1000mL = 1L$ $\quad 300mL \times \frac{1L}{1000mL} = 0.3L$

Determine the ions still in solution after the reaction.

$KOH \rightarrow K^+ + OH^-$
0.01 → 0.01 + 0.01

$KCl \rightarrow K^+ + Cl^-$
0.05 → 0.05 + 0.05

Determine the molarity of the ions in solution after the reaction.

300mL + 500mL = 800mL

$800mL \times \frac{L}{1000mL} = 0.8L$

K^+: 0.01 + 0.05 = 0.06 mol

$M = \frac{0.06 mol}{0.8L} = 0.075M$ K^+

OH^-: $\frac{0.01 mol}{0.8L} = 0.0125M$ OH^-

Cl^-: $M = \frac{0.05 mol}{0.8L} = 0.0625M$ Cl^-

300 mL of 0.2 M KOH is poured into a beaker of 500mL of 0.1 M HCl.
Write the equation, determine the limiting reactant.
Determine the concentration of each ion after the reaction.

Write the equation. Make an ISE table.

	KOH(aq) +	HCl (aq)	⟶ HOH(l)	+ KCl(aq)
I	0.06 mol	0.05 mol		
S	0.05 mol	0.05 mol	0.05 mol	0.05 mol
E	0.01 mol excess	0	0.05 mol	0.05 mol

Determine moles of reactants and limiting reactant. Fill out ISE.

KOH

$0.2\ M = \frac{x\ mol}{0.3L}$

x= 0.06 mol KOH

HCl

$0.1\ M = \frac{x\ mol}{0.5L}$

x= 0.05 mol HCl

HCl is the limiting reactant

Determine the ions still in solution after the reaction.

(excess) KOH ⟶ K^{+1} + OH^{-1}
0.01 mol 0.01 0.01

aq. product: KCl ⟶ K^{+1} + Cl^{-1}
0.05 mol 0.05 0.05

Determine the molarity of the ions in solution after the reaction.

final volume:
300mL
+500mL
800mL

K^{+1}

$\frac{0.01+0.05\ mol}{0.8L} = 0.075M$

OH^{-1}

$\frac{0.01mol}{0.8L} = 0.0125M$

Cl^{-1}

$\frac{0.05mol}{0.8L} = 0.0625M$

20 mL of 0.5M Na_2SO_4 reacts with completely with 25 mL of $Ca(NO_3)_2$

What is the molarity of the $Ca(NO_3)_2$?

(1.) equivalence
all reactant gone / no excess

Ag^+ NO_3^- Na^+ Cl^-

(c.)

$1AgNO_{3(aq)} + 1NaCl_{(aq)} \rightarrow 1AgCl_{(s)} + NaNO_{3(aq)}$

S: −0.002, −0.002 mol, +0.002, +0.002

.020 ml 0.1 M

$M = \frac{mol}{L}$ $0.1M = \frac{X\ mol}{0.020L}$

(b.) X = 0.002 mol $AgNO_3$

(d.) 0.002 mol $AgNO_3$ → need 0.002 mol NaCl

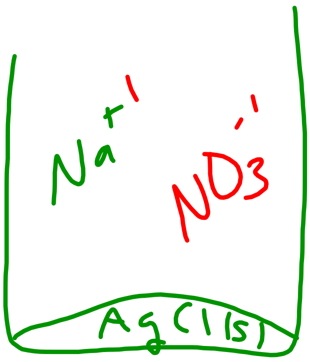
$0.05M = \frac{0.002mol}{X}$

$\frac{0.05X}{0.05} = \frac{0.002}{0.05}$

X = 0.04 NaCl 0.002 mol

$0.04L \left| \frac{1000mL}{1L} \right. = 40\ mL$

= 0.04 L NaCl 40 mL



40 mL
20 mL
60 mL

$60mL \left| \frac{1L}{1000mL} \right. = 0.06\ L$

$\frac{0.002mol}{0.06L}$

(e.) = 0.033 M Na^+

0.033 M Cl^-

(LR)

a. $NaOH_{(aq)} + HCN_{(aq)} \rightarrow HOH_{(l)} + NaCN_{(aq)}$

	NaOH	HCN	HOH	NaCN
I	0.004	0.005		
C	-0.004	-0.004	+0.004	+0.004
E	0	0.001 excess	0.004	0.004

b. $0.2M = \frac{x \text{ mol}}{0.02L}$

$x = 0.004$ mol NaOH

$0.1M = \frac{x \text{ mol}}{0.05L}$

$x = 0.005$ mol HCN

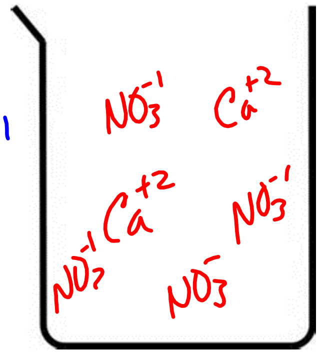
c. no solid (creating $HOH_{(l)}$)

d. 0

1. In the beaker 82g of $Ca(NO_3)_2$ is being dissolved in 100mL of water. Draw a rough sketch of the solution.

$$Ca(NO_3)_2 \rightarrow Ca^{+2} + 2NO_3^{-1}$$

① ion
② Balance



2. What is the molarity of the $Ca(NO_3)_2$?

0.5

$$\frac{100\,mL \mid 1\,L}{\mid 1000\,mL} = 0.1\,L$$

Ca $40 \times 1 = 40$
N $14 \times 2 = 28$
O $16 \times 6 = 96$
$164\,g/mol$

$$\frac{82\,g\,Ca(NO_3)_2 \mid 1\,mol}{\mid 164\,g} = 0.5\,mol$$

$$M = \frac{0.5\,mol}{0.1\,L} = 5\,M$$

3. What is the percent mass of $Ca(NO_3)_2$ in the solution?

$$\frac{\text{mass solute}}{\text{total mass}} \times 100$$

$$\frac{82\,g}{82 + 100} \times 100 = 45.1\%\ Ca(NO_3)_2$$

4. What would be the actual number of moles of NO_3^{-1} ions floating in the solution?

$$1\,Ca(NO_3)_2 \rightarrow 1\,Ca^{+2} + 2NO_3^{-1}$$

0.5 mol　0.5 mol　1 mol

1 mol NO_3^{-1}

5. What is the molarity of the NO_3^{-1}?

$$M = \frac{mol}{L} = \frac{1\,mol}{0.1\,L} = 10\,M$$

$$\frac{100\,mL \mid 1\,L}{\mid 1000\,mL} = 0.1\,L$$

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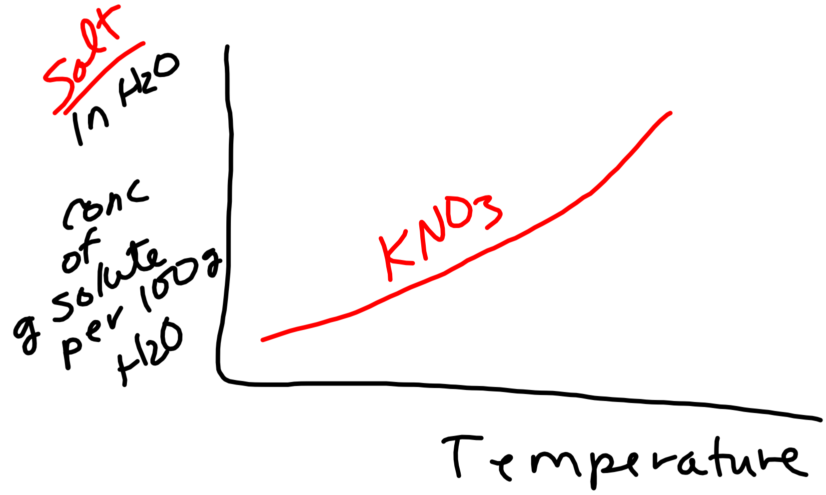
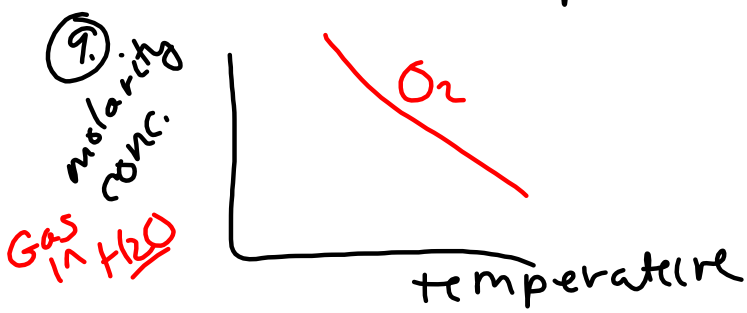
1. If you keep adding more and more $Ca(NO_3)_2$ to the solvent the solution will eventually become ___saturated___

7 2. What is the only factor that would allow you to actually add more solute per solvent?

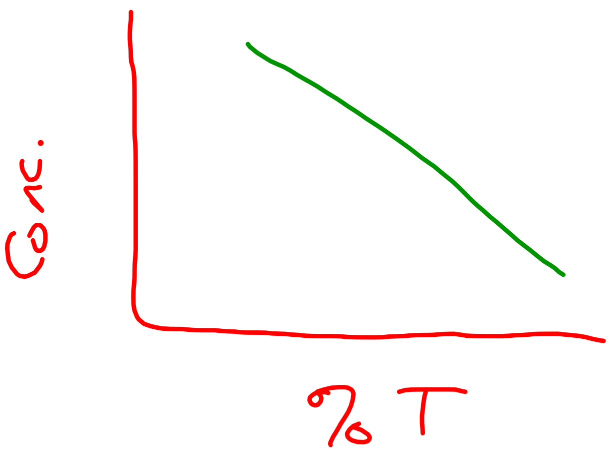
increase temp.





8 In the chart given, sketch out the relationship between Concentratior and % T of light. Label the axis.

Beer's Law



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#4

$Ca^{+2}\ Cl^{-1}$ $Na^{+1}\ PO_4^{-3}$ +1 −1 +2 −3

(L.R.)

Rate Quantities

$3CaCl_{2(aq)} + 2Na_3PO_{4(aq)} \rightarrow 6NaCl_{(aq)} + 1Ca_3(PO_4)_{2(s)}$

	$CaCl_2$	Na_3PO_4	NaCl	$Ca_3(PO_4)_2$
I	0.01	0.02		
S	−0.01	−0.0067	+0.02	+0.0033
E	Ø	0.0133 (excess) $3Na^+\ PO_4^{-3}$	0.02 $Na^+\ Cl^-$	0.0033 solid

$CaCl_2$

$0.2M = \frac{x\ mol}{0.05L}$

x = 0.01 mol

$50mL \mid \frac{1L}{1000mL} = 0.05$

Na_3PO_4

$0.4M = \frac{x\ mol}{0.05L}$

x = 0.02 mol

$0.01\ CaCl_2 \mid \frac{2\ Na_3PO_4}{3\ CaCl_2} = 0.0067\ mol\ Na_3PO_4$

$0.01\ CaCl_2 \mid \frac{6\ NaCl}{3\ CaCl_2} = 0.02\ mol\ NaCl$

$0.01\ CaCl_2 \mid \frac{1\ Ca_3(PO_4)_2}{3\ CaCl_2} = 0.0033\ mol\ Ca_3(PO_4)_2$

$Na_3PO_4 \rightarrow 3Na^+ + PO_4^{-3}$

0.0133 → 0.04, 0.0133

$NaCl \rightarrow Na^+ + Cl^-$

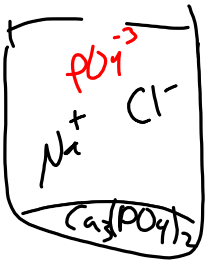
0.02 → 0.02, 0.02

50 mL
50 mL
100 mL → 0.1L

$\frac{0.04 + 0.02\ mol}{0.1L} = 0.6M\ Na^+$

$\frac{0.0133}{0.1L} = 0.133M\ PO_4^{-3}$

$\frac{0.02}{0.1} = 0.2\ M\ Cl^-$



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