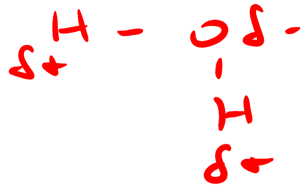
13) a) polar solute - a polar covalent compound with an uneven distribution of electrons, causing a partial positive and partial negative end



* polar solutes dissolve in polar water

nonpolar solute - do not have a permanent partial positive and negative ends

* nonpolar solutes do not dissolve in water

b) KF is a soluble ionic compounds it is a strong electrolyte

$$KF_{(s)} \longrightarrow K^+_{(aq)} + F^-_{(aq)}$$

$C_6H_{12}O_6$ is a polar covalent molecule it is a nonelectrolyte

$$C_6H_{12}O_{6(s)} \longrightarrow C_6H_{12}O_{6(aq)}$$

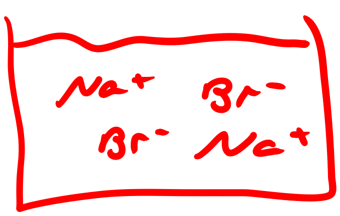
c) RbCl is a strong electrolyte

$$RbCl_{(s)} \longrightarrow Rb^+_{(aq)} + Cl^-_{(aq)}$$

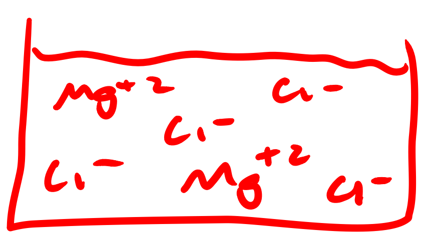
AgCl is insoluble in water so will form a precipitate

25) $CaCl_{2(s)} \longrightarrow Ca^{+2}_{(aq)} + 2Cl^{-}_{(aq)}$

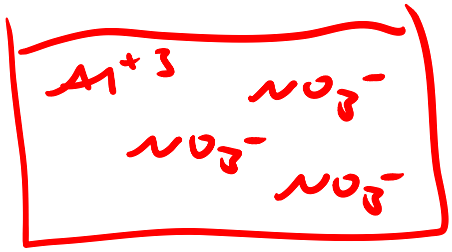
23) a) $NaBr_{(s)} \longrightarrow Na^{+}_{(aq)} + Br^{-}_{(aq)}$



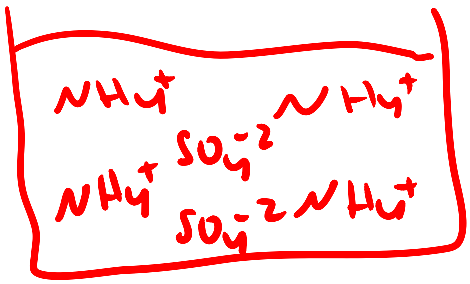
b) $MgCl_{2\,(s)} \longrightarrow Mg^{+2}_{(aq)} + 2Cl^{-}_{(aq)}$



c) $Al(NO_3)_{3(s)} \rightarrow Al^{+3}_{(aq)} + 3NO_{3(aq)}^{-}$



d) $(NH_4)_2SO_{4(s)} \rightarrow 2NH_{4(aq)}^{+} + SO_{4(aq)}^{-2}$



e) $NaOH_{(s)} \rightarrow Na^{+}_{(aq)} + OH^{-}_{(aq)}$

f) $FeSO_{4(s)} \rightarrow Fe^{+2}_{(aq)} + SO_{4(aq)}^{-2}$

g) $KMnO_{4(s)} \rightarrow K^{+}_{(aq)} + MnO_{4(aq)}^{-}$

h) $HClO_{4(s)} \rightarrow H^{+}_{(aq)} + ClO_{4(aq)}^{-}$

i) $NH_4C_2H_3O_{2(s)} \rightarrow NH_{4(aq)}^{+} + C_2H_3O_{2(aq)}^{-}$

27) a) $5.623 g\ NaHCO_3 \times \frac{1 mol\ NaHCO_3}{84.01 g\ NaHCO_3} = 6.693 \times 10^{-2} mol\ NaHCO_3$

$M = \frac{mol}{L} = \frac{6.693 \times 10^{-2} mol}{250.0 ml} \times \frac{1000 ml}{1 L} = 0.2677 M\ NaHCO_3$

b) $0.1846 g\ K_2Cr_2O_7 \times \frac{1 mole\ K_2Cr_2O_7}{294.20 g\ K_2Cr_2O_7} = 6.275 \times 10^{-4} mol\ K_2Cr_2O_7$

$M = \frac{mol}{L} = \frac{6.275 \times 10^{-4} mol}{500.0 ml} \times \frac{1000 ml}{1 L} = 1.255 \times 10^{-3} M\ K_2Cr_2O_7$

c) $0.1025 g\ Cu \times \frac{1 mole\ Cu}{63.55 g\ Cu} = 1.613 \times 10^{-3} mol\ Cu$

$1.613 \times 10^{-3} mol\ Cu = 1.613 \times 10^{-3} mol\ Cu^{+2}$

$M = \frac{mol}{L} = \frac{1.613 \times 10^{-3} mol}{200.0 ml} \times \frac{1000 ml}{1 L} = 8.065 \times 10^{-3} M\ Cu^{+2}$

29 a) $M_{Ca(NO_3)_2} = \frac{0.100 mol}{0.100 L} = 1.00 M$

	$Ca(NO_3)_{2(s)}$	$\longrightarrow$	$Ca^{+2}_{(aq)}$	+	$2 NO_3^-$
I	1.00 M		0		0
C	- 1.00 M		+ 1.00 M		+ 2 (1.00 M)
F	0		1.00 M		2.00 M

b) $M_{Na_2SO_4} = \frac{2.5 \text{ mol}}{1.25 \text{ L}} = 2.0M$

$Na_2SO_{4(s)} \longrightarrow 2Na^+_{(aq)} + SO_4^{-2}{}_{(aq)}$

$[Na^+] = 2(2.0M) = 4.0M$

$[SO_4^{-2}] = 2.0M$

c) $5.00g\ NH_4Cl \frac{1 \text{ mol } NH_4Cl}{53.49g\ NH_4Cl} = 0.0935 \text{ mol } NH_4Cl$

$M_{NH_4Cl} = \frac{0.0935 \text{ mol}}{0.5000 L} = 0.187M\ NH_4Cl$

$NH_4Cl_{(s)} \longrightarrow NH_4^+{}_{(aq)} + Cl^-{}_{(aq)}$

$[NH_4^+] = 0.187M$

$[Cl^-] = 0.187M$

d) $1.00g\ K_3PO_4 \frac{1 \text{ mole } K_3PO_4}{212.27g\ K_3PO_4} = 4.71 \times 10^{-3} \text{ mol } K_3PO_4$

$M_{K_3PO_4} = \frac{4.71 \times 10^{-3} \text{ mol}}{0.2500 L} = 0.0188M$

$K_3PO_{4(s)} \longrightarrow 3K^+_{(aq)} + PO_4^{-3}{}_{(aq)}$

$[K^+] = 3(0.0188M) = 0.0564M$

$[PO_4^{-3}] = 0.0188M$

31) mole = volume × molarity

$AlCl_{3(s)} \rightarrow Al^{+3}_{(aq)} + 3Cl^-_{(aq)}$

$\text{mole } Cl^- = 0.1000L \; \frac{0.30 \text{ mole } AlCl_3}{1 \; L} \; \frac{3 \text{ mole } Cl^-}{1 \text{ mole } AlCl_3} = 9.0 \times 10^{-2} \text{ mole } Cl^-$

$MgCl_{2(s)} \rightarrow Mg^{+2}_{(aq)} + 2Cl^-_{(aq)}$

$\text{mole } Cl^- = 0.05000L \; \frac{0.60 \text{ mole } MgCl_2}{1L} \; \frac{2 \text{ mole } Cl^-}{1 \text{ mole } MgCl_2} = 6.0 \times 10^{-2} \text{ mole } Cl^-$

$NaCl_{(s)} \rightarrow Na^+_{(aq)} + Cl^-_{(aq)}$

$\text{mole } Cl^- = 0.2000L \; \frac{0.40 \text{ mole } NaCl}{1L} \; \frac{1 \text{ mole } Cl^-}{1 \text{ mole } NaCl} = 8.0 \times 10^{-2} \text{ mole } Cl^-$

* 100.0 mL of 0.30 M $AlCl_3$ has the most moles of Cl^-

33) mass NaOH : $0.2500\,L \times \frac{0.400\,mole\,NaOH}{1\,L} \times \frac{40.00\,g\,NaOH}{1\,mole\,NaOH} =$

$4.00\,g\,NaOH$

35) a) $2.00\,L \times \frac{0.250\,mole\,NaOH}{1\,L} \times \frac{40.00\,g\,NaOH}{1\,mole\,NaOH} = 20.0\,g\,NaOH$

Place 20.0 g NaOH in a 2.00 L volumetric flask, add water to dissolve the NaOH, fill to the mark with water, mixing several times

b) $2.00\,L \times \frac{0.250\,mole\,NaOH}{1\,L} \times \frac{1\,L\,stock}{1.00\,mole\,NaOH} = 0.500\,L$

add 500. ml of 1.00 M NaOH to a 2.0 L volumetric flask, fill to the mark with water, mixing several times

c) $2.00\,L \times \frac{0.100\,mol\,K_2CrO_4}{1\,L} \times \frac{194.20\,g\,K_2CrO_4}{1\,mole\,K_2CrO_4} = 38.8\,g\,K_2CrO_4$

similar to part a

d) $2.00\,L \times \frac{0.100\,mole\,K_2CrO_4}{1\,L} \times \frac{1\,L\,stock}{1.75\,mole\,K_2CrO_4} = 0.114\,L$

similar to part b

37) $10.8\,g\ (NH_4)_2SO_4 \ \frac{1\ mole\ (NH_4)_2SO_4}{132.15\,g\ (NH_4)_2SO_4} = 8.17\times10^{-2}\ mole\ (NH_4)_2SO_4$

$M = \frac{mole}{L} = \frac{8.17\times10^{-2}\ mole}{100.0\ ml}\ \frac{1000\ ml}{1\ L} = 0.817\ M\ (NH_4)_2SO_4$

moles $(NH_4)_2SO_4$

$10.00\times10^{-3}\ L\ \frac{0.817\ mol}{1\ L} = 8.17\times10^{-3}\ mole$

$M = \frac{8.17\times10^{-3}\ mol}{(10.00 + 50.00)\ ml}\ \frac{1000\ ml}{1\ L} = 0.136\ M\ (NH_4)_2SO_4$

$(NH_4)_2SO_{4(s)} \longrightarrow 2\,NH_4^+{}_{(aq)} + SO_4^{-2}{}_{(aq)}$

$[NH_4^+] = 2(0.136) = 0.272\ M$

$[SO_4^{-2}] = 0.136\ M$

38) mole $Na_2CO_3 = 0.0700\ L\ \frac{3.0\ mole\ Na_2CO_3}{1\ L} = 0.21\ mole\ Na_2CO_3$

$Na_2CO_{3(s)} \longrightarrow 2\,Na^+{}_{(aq)} + CO_3^{-2}{}_{(aq)}$

mole $Na^+ = 2(0.21) = 0.42$ mole Na^+

mole $NaHCO_3 = 0.0300\ L\ \frac{1.0\ mole\ NaHCO_3}{1\ L} = 0.030\ mol\ NaHCO_3$

$NaHCO_{3(s)} \longrightarrow Na^+{}_{(aq)} + HCO_3^-{}_{(aq)}$

mole $Na^+ = 0.030$ mole Na^+

$[Na^+] = \frac{(0.42 + 0.030)\ mol}{(0.0700 + 0.0300)\ L} = 4.5\ M\ Na^+$

4) $0.5842\,g \times \frac{1\,mole}{90.04\,g} = 6.488 \times 10^{-3}$ mole $H_2C_2O_4$

$\frac{6.488\,mole}{100.0\,ml} \times \frac{1000\,ml}{1\,L} = 6.488 \times 10^{-2}\,M$

initial concentration

$10.00 \times 10^{-3}\,L \times \frac{6.488 \times 10^{-2}\,mol}{1\,L} = 6.488 \times 10^{-4}$ mol $H_2C_2O_4$

in aliquot

$M = \frac{6.488 \times 10^{-4}\,mol}{0.2500\,L} = 2.595 \times 10^{-3}\,M\ H_2C_2O_4$

final concentration