4.2 a) This solution is a non-electrolyte as it contains no free-moving charged particles.

b) This solution is a weak electrolyte as it contains a mixture of free-moving charged particles and neutral molecules.

c) This solution is a strong electrolyte as it contains only charged ions.

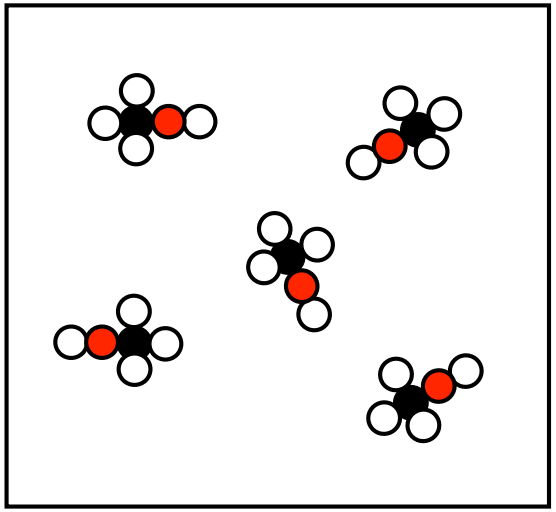
4.3 a) This molecule will be a weak electrolyte as it contains a COOH group, making it a weak organic acid.

b) This molecule of nitric acid is a strong electrolyte.

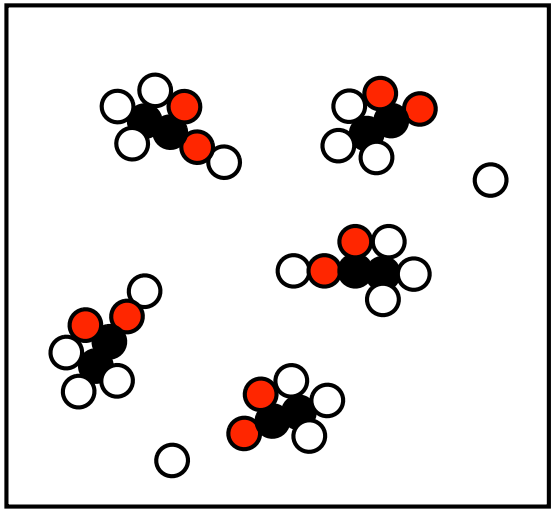
c) This alcohol molecule is a non-electrolyte as it does not dissociate in water.

4.5 Because the salt in questions dissolves in water, we know that it can't be insoluble $PbCl_2$. Because the salt solution formed precipitates with the addition of Na_2SO_4, we can rule out $ZnCl_2$, since $ZnSO_4$ is water soluble and won't precipitate. This leave us with $BaCl_2$, supported by the fact that $BaSO_4$ in not water soluble.

4.14



Because CH_3OH does not dissociate in water there are no charged particles to carry a current



Because CH_3COOH partially dissociates in water it contains a low concentration of current carrying charged particles

4.17 a) Zn^{2+}, Cl^-

b) H^+, NO_3^-

c) NH_4^+, SO_4^{2-}

d) Ca^{2+}, OH^-,

4.20a) Possible particles in solution are:

Acetone = CH_3COCH_3

Hypochlorous acid = H^+, ClO^-, $HClO$

Ammonium chloride = NH_4^+, Cl^-

4.20b) If 0.1mol of each compound is dissolved in water the ammonium chloride solution will contain 0.2 mol of solute particles because each formula unit completely dissociates into 2 solute particles. Acetone will contain 0.1 mol of solute particles because these molecules do not dissociate at all. Hypochlorous acid will contain between 0.1 and 0.2 mol solute particles because some (but not all) molecules will dissociate.

4.22 a) insoluble b) soluble c) soluble d) insoluble e) soluble

4.23 a) $Na_2CO_3 + 2AgNO_3 \Rightarrow \mathbf{Ag_2CO_{3(s)}} + 2NaNO_3$

b) no precipitate will form

c) $FeSO_4 + Pb(NO_3)_2 \Rightarrow \mathbf{PbSO_{4(s)}} + Fe(NO_3)_2$

4.26a) $Cr_2(SO_4)_{3(aq)} + 3(NH_4)_2CO_{3\,(aq)} \Rightarrow Cr_2(CO_3)_{3\,(s)} + 3(NH_4)_2SO_{4\,(aq)}$

$2Cr^{3+} + 3\mathbf{SO_4^{2-}} + 6\mathbf{NH_4^{+}} + 3CO_3^{2-} \Rightarrow Cr_2(CO_3)_3 + 6\mathbf{NH_4^{+}} + 3\mathbf{SO_4^{2-}}$

$2Cr^{3+} + 3CO_3^{2-} \Rightarrow Cr_2(CO_3)_3$

4.26b) $Ba^{2+} + SO_4^{2-} \Rightarrow BaSO_4$ (K^+ and NO_3^- are spectators)

4.26c) $Fe^{2+} + 2OH^- \Rightarrow Fe(OH)_2$ (K^+ and NO_3^- are spectators)

4.27

Compound	$Ba(NO_3)_2$ Result	NaCl result
$AgNO_3$	no ppt	AgCl ppt
$CaCl_2$	no ppt	no ppt
$Al_2(SO_4)_3$	$BaSO_4$ ppt	no ppt

Based on the possible outcomes of reacting the unknown solution with our two test solutions, we can see that a positive test with barium nitrate identifies the solution as aluminum sulfate, a positive test with sodium chloride identifies the solution as silver nitrate and two negative tests identifies the solution as calcium chloride.