42.081 g/mol — 53.064 g/mol

$$4\,C_3H_6 + 6\,NO \longrightarrow 4\,C_3H_3N + 6\,H_2O + N_2$$

propylene — acrylonitrile

Calculate how many grams of acrylonitrile could be obtained from 651 kg of propylene, assuming there is excess NO present.

---

1 - Convert 651 kg of propylene to moles using formula weight (and kg -> g conversion)
2 - Convert mol propylene to mol acrylonitrile using chemical equation
3 - Convert mol acrylonitrile to mass using formula weight.

42.081 g C_3H_6 = mol C_3H_6 | 4 mol C_3H_6 = 4 mol C_3H_3N |

53.064 g C_3H_3N = mol C_3H_3N | kg = 10^3 g

$$651\,\text{kg}\,C_3H_6 \times \frac{10^3\,\text{g}}{\text{kg}} \times \frac{\text{mol}\,C_3H_6}{42.081\,\text{g}\,C_3H_6} \times \frac{4\,\text{mol}\,C_3H_3N}{4\,\text{mol}\,C_3H_6} \times \frac{53.064\,\text{g}\,C_3H_3N}{\text{mol}\,C_3H_3N} =$$

(1) (2) (3)

$$= \boxed{821000\,\text{g}\,C_3H_3N}\ (821\,\text{kg})$$

151.90 g/mol

$$10\,FeSO_4 + 2\,KMnO_4 + 8\,H_2SO_4 \rightarrow 5\,Fe_2(SO_4)_3 + 2\,MnSO_4 + K_2SO_4 + 8\,H_2O$$

How many mL of 0.250M potassium permangenate are needed to react with 3.36 g of iron(II) sulfate?

---

1 - Convert mass iron(II) sulfate to moles using formula weight.
2 - Convert moles iron(II) sulfate to moles potassium permangenate using chemical equation
3 - Convert moles potassium permangenate to volume using concentration.

151.90 g $FeSO_4$ = mol $FeSO_4$ | 10 mol $FeSO_4$ = 2 mol $KMnO_4$ | 0.250 mol $KMnO_4$ = L

mL = 10^{-3} L

$$3.36\,g\,FeSO_4 \times \frac{mol\,FeSO_4}{151.90\,g\,FeSO_4} \times \frac{2\,mol\,KMnO_4}{10\,mol\,FeSO_4} \times \frac{L}{0.250\,mol\,KMnO_4} \times \frac{mL}{10^{-3}\,L} =$$

(1) (2) (3)

$$= \boxed{17.7\,mL\ of\ 0.250\,M\ KMnO_4}$$

Electrolytes and Ionic Theory

- electrolytes: substances that dissolve in water to form charge-carrying solutions

* Electrolytes form ions in solution - (ions that are mobile are able to carry charge!). These IONS can undergo certain kinds of chemistry!

IONIC THEORY

- the idea that certain compounds DISSOCIATE in water to form free IONS

What kind of compounds?

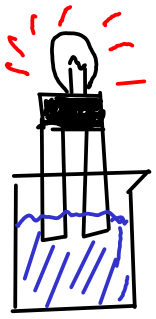
- Soluble ionic compounds
- Acids (strong AND weak)
- Bases (strong AND weak)

The ions formed may interact with each other to form NEW compounds!

Strong vs weak?

- If an electrolyte COMPLETELY IONIZES in water, it's said to be STRONG
- If an electrolyte only PARTIALLY IONIZES in water, it's said to be WEAK
- Both kinds of electrolyte undergo similar kinds of chemistry.

Ionic theory experiment



Simple conductivity tester: The stronger the electrolyte, the brighter the light.

SOME PURE COMPOUNDS (MOLECULAR AND IONIC)

DISTILLED WATER

No light. Pure water is a NONCONDUCTOR - it doesn't carry an appreciable electric current.

SOLID SODIUM CHLORIDE

Nonconductor (no light). There ARE potential charge carriers, but they're locked into the NaCl crystal structure.

SOLID SUCROSE $C_{12}H_{22}O_{11}$

Like water, sucrose is a NONCONDUCTOR. typical for molecular substances.

MOLECULAR AND IONIC SOLUTIONS

SODIUM CHLORIDE + WATER

Bright light. Sodium chloride (like all soluble ionic compounds) is a STRONG ELECTROLYTE that breaks apart in water to form ions.

SUCROSE + WATER

No light. Sucrose is a NONELECTROLYTE - its solutions do not carry a current. When sucrose dissolves, it remains as molecules. (Typical of molecular substances)

ACIDS

PURE (GLACIAL) ACETIC ACID

No light. Like water, this molacular substance does not conduct electricity in the liquid state, since there are no charge carriers (i.e.. ions) to carry a current.

ACETIC ACID + WATER

Dim ight. Acetic acid is a WEAK ELECTROLYTE - meaning that SOME (but not all) acetic acid molecules ionize in water.

2M ACETIC ACID (AQUEOUS)

Somewhat of a dim light. So, acetic acid is a WEAK ELECTROLYTE, since the same concentration of HCl gave a much brighter glow.

2M HYDROCHLORIC ACID (AQUEOUS)

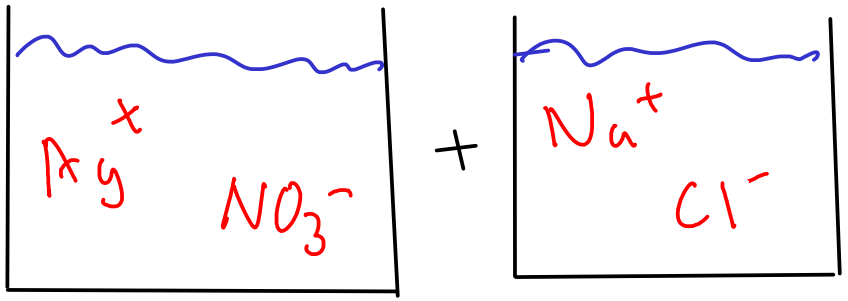
Bright light. Hydrochloric acid is a STRONG ELECTROLYTE (or, at least, a stronger electrolyte than acetic acid!)

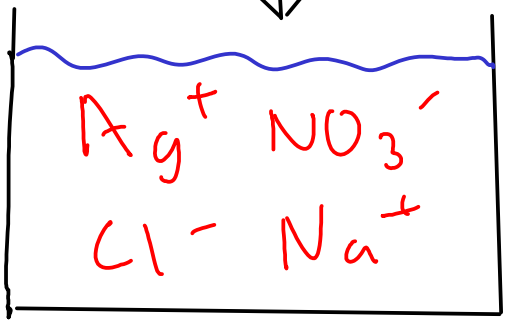
- What good is ionic theory?

- provides an easy-to-understand MECHANISM for certain kinds of chemical reactions.

- "Exchange" reactions. (a.k.a "double replacement" reactions)

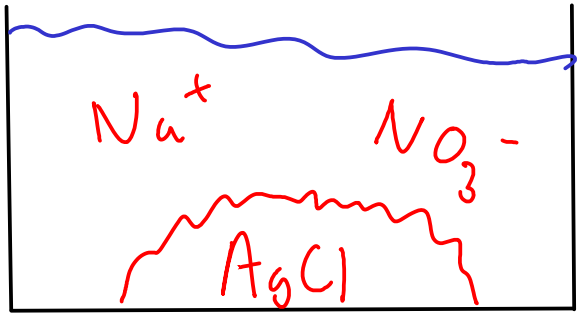
$$AgNO_3(aq) + NaCl(aq) \longrightarrow AgCl(s) + NaNO_3(aq)$$





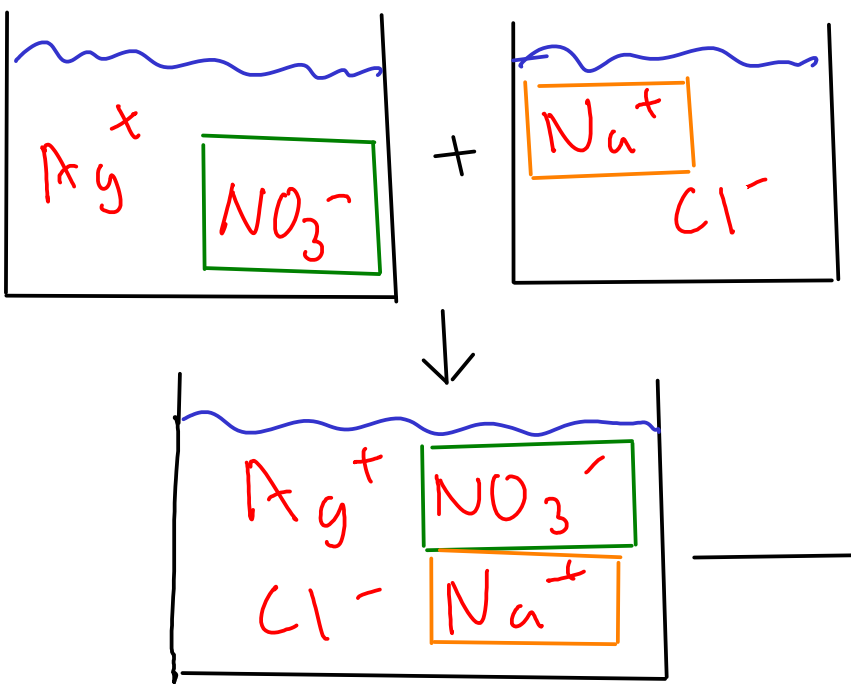
These free ions mix and can interact with each other!

"ion soup"!



Insoluble AgCl falls out of solution as it is formed - "precipitation"

Looking a bit more closely...



The nitrate and sodium ions do not really participate in this reaction. They start and end in exactly the same state. We call them "SPECTATOR IONS".

$AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s) + NaNO_3(aq)$ "Molecular equation"

$Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$ "Net ionic equation"

(The net ionic equation shows only ions and substances that change during the course of the reaction!)

- The net ionic equation tells us that any source of aqueous silver and chloride ions will exhibit this same chemistry, not just silver nitrate and sodium chloride!