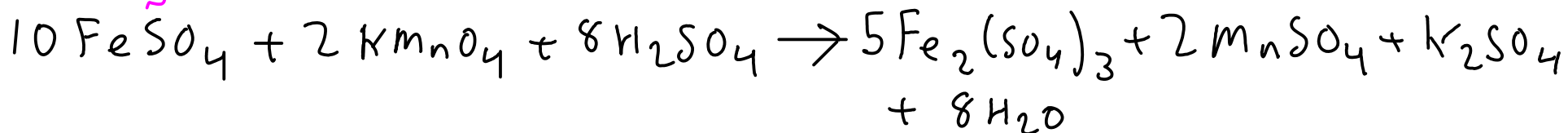


151.90 g/mol



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

- 1 - Convert 3.36 g of iron(II) sulfate to moles. Use formula weight.
- 2 - Convert moles iron(II) sulfate to moles potassium permanganate. Use chemical equation.
- 3 - Convert moles potassium permanganate to volume. Use molar concentration (0.250 M)

$$151.90 \text{ g FeSO}_4 = \text{mol FeSO}_4 \quad | \quad 10 \text{ mol FeSO}_4 = 2 \text{ mol KMnO}_4$$

$$0.250 \text{ mol KMnO}_4 = \text{L} \quad \text{mL} = 10^{-3} \text{ L}$$

$$3.36 \text{ g FeSO}_4 \times \frac{\text{mol FeSO}_4}{151.90 \text{ g FeSO}_4} \times \frac{2 \text{ mol KMnO}_4}{10 \text{ mol FeSO}_4} \times \frac{\text{L}}{0.250 \text{ mol KMnO}_4} \times \frac{\text{mL}}{10^{-3} \text{ L}} =$$

①
②
③

$$= \boxed{17.7 \text{ mL of } 0.250 \text{ M KMnO}_4}$$

- 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?

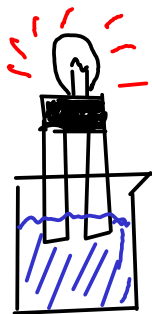
- Soluble ionic compounds
- Acids (strong AND weak)
- Bases (strong AND weak)

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. (Typical for molecules!)

SOLID SODIUM CHLORIDE

No light. Solid NaCl is a nonconductor. Even though NaCl is ionic, the ions cannot move independently in the solid state.

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

No light. Solid sucrose (typical of molecules in the solid state) is a nonconductor.

MOLECULAR AND IONIC SOLUTIONS

SODIUM CHLORIDE + WATER

Bright light. Sodium chloride is an **ELECTROLYTE**. (Like other soluble ionic compounds, it's a **STRONG ELECTROLYTE**. It breaks apart completely in water to form free ions.)

SUCROSE + WATER

No light. Sucrose is a **NONELECTROLYTE**. Sucrose molecules do not react with water (or break apart) to form ions. This is typical of most (but not all) molecules.

ACIDS

PURE (GLACIAL) ACETIC ACID

No light. Like water, pure acetic acid is a molecular substance and does not conduct electricity in the liquid state. (No charge carriers that can move around independently!)

ACETIC ACID + WATER

Dim light. Acetic acid is a **WEAK ELECTROLYTE**. **SOME** molecules of acetic acid react with water to form ions (which can carry a charge), but others do not.

2M ACETIC ACID (AQUEOUS)

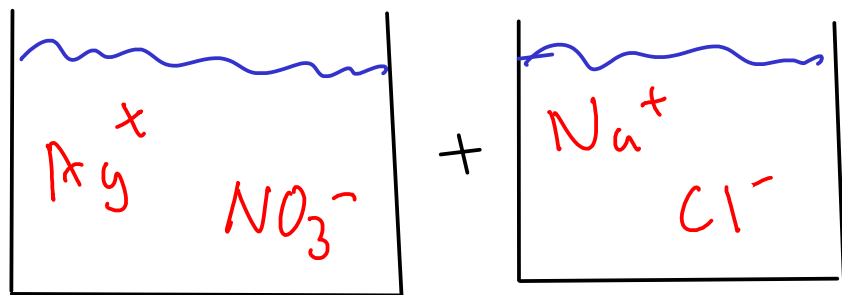
Somewhat dim light. Acetic acid is a **WEAK ELECTROLYTE**, since the same concentration and amount of HCl gives a much brighter light.

2M HYDROCHLORIC ACID (AQUEOUS)

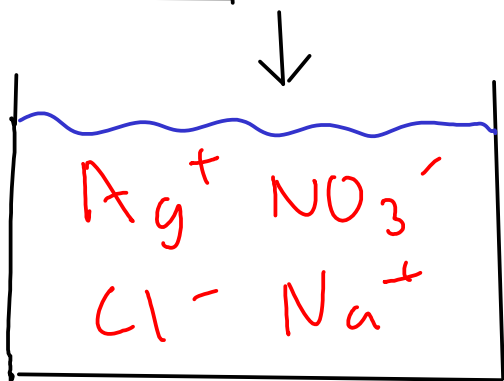
Bright light. HCl is a **STRONG ELECTROLYTE**. (Or, at least it's a stronger electrolyte than acetic acid!)

113 - What good is ionic theory?

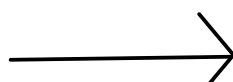
- provides an easy-to-understand MECHANISM for certain kinds of chemical reactions.
 - "Exchange" reactions. (a.k.a "double replacement" reactions)



These free ions mix and can interact with each other!

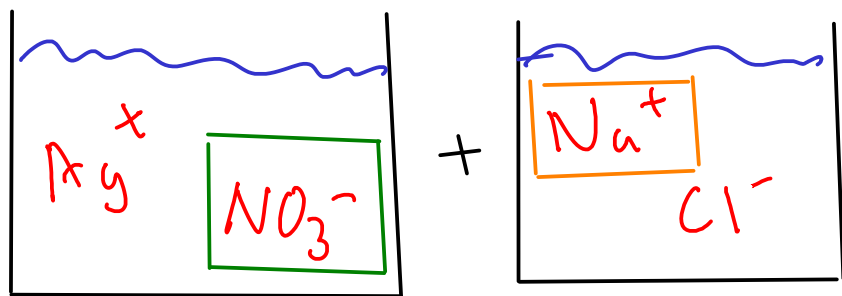


"ion soup"!

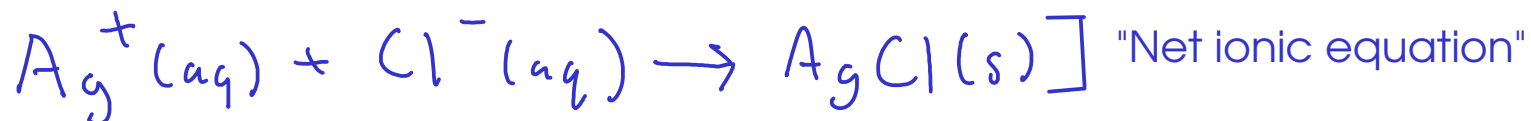
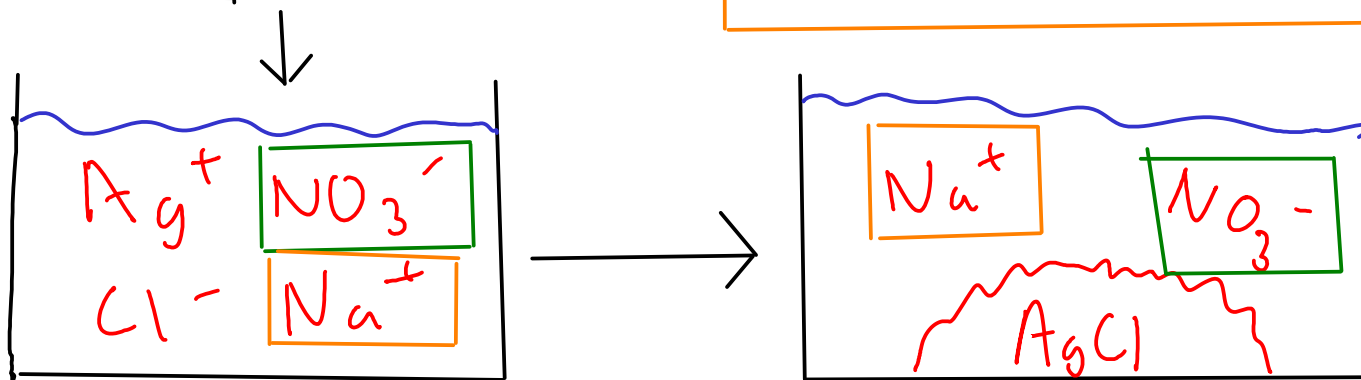


Insoluble AgCl falls out of solution as it is formed - "precipitation"

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".



(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!