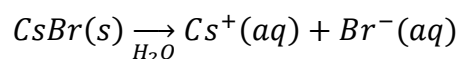


# Conductivity and Electrolytes

In this experiment<sup>1</sup>, you will determine whether or not several solutions are electrolyte solutions, based on whether or not they conduct electricity.

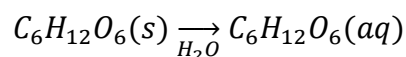
## Introduction

In order to conduct electricity, a solution needs to have ions (charged particles) to carry electrical charge from one electrode to another, and those ions must be mobile. An ionic compound, such as CsBr(s) has ions, but they are fixed in a solid crystal lattice. However, when dissolved in water



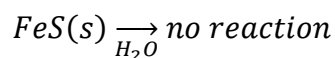
the ions become mobile, and the resulting solution will conduct electricity.

Some compounds dissolve in molecule form rather than dissociate into ions. An example is fructose.



The solution resulting from dissolving this sugar in water is not an electrolyte as it does not conduct electricity.

Some ionic substances do not dissociate in water, and thus can not dissolve. An example is iron (II) sulfide:



In this experiment, you will observe the conductivity properties of several solutions and mixtures of solutions, and draw conclusions about the natures of these solutions and mixtures.

---

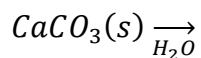
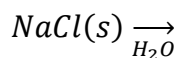
<sup>1</sup> This experiment is based (loosely) on the Experiment found at [LibreTexts.org](https://libretexts.org/), [Electrical Conductivity of Aqueous Solutions](#)

## Part A - Conductivity

In Part A, you will examine water, NaCl, and CaCO<sub>3</sub>, and combinations there of. Complete the following table based on your observations.

Substance(s)	Conductivity
Water	
NaCl(s)	
CaCO <sub>3</sub> (s)	
Water + NaCl	
Water + CaCO <sub>3</sub>	

Based on your observations, write net ionic reactions for the following:

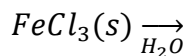
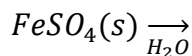
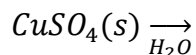
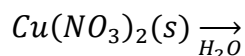
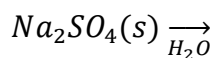
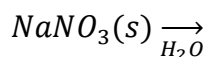
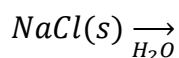
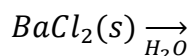
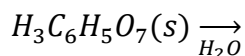
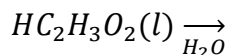
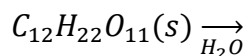
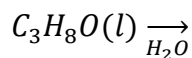


## Part B – Conductivity of Solutions

Measure the conductivity of the following solutions, and classify each solute as a **strong electrolyte**, a **weak electrolyte**, or a **nonelectrolyte**. Based on your classification, write a net (ionic) reaction for the process of the solute dissolving in water.

Solute	Conductivity	Categorization
Isopropyl alcohol		
Sucrose		
Acetic Acid		
Citric Acid		
Barium chloride		
Sodium chloride		
Sodium nitrate		
Sodium sulfate		
Copper (II) nitrate		
Copper (II) sulfate		
Iron (II) sulfate		
Iron (III) chloride		

## Reactions

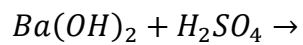


## Part C – Conductivity and Chemical Reactions

In this part, you will use the results of your conductivity measurements to draw conclusions about the reaction of  $Ba(OH)_2$  and  $H_2SO_4$ .

Solution(s)	Conductivity
2.0 mL 0.010 M $Ba(OH)_2$	
2.0 mL 0.010 M $H_2SO_4$	
2.0 mL 0.010 M $Ba(OH)_2$ + 2.0 mL 0.010 M $H_2SO_4$	

Based on your observations, indicate the net ionic reaction below:



## Exp 24 – Conductivity and Electrolytes – Prelaboratory Assignment

Name \_\_\_\_\_

Date \_\_\_\_\_

The following table contains some ions commonly found in Nature.

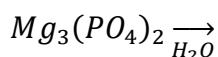
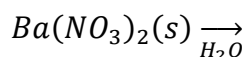
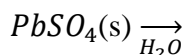
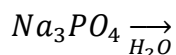
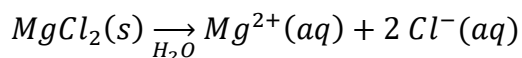
Cations		Anions	
Na <sup>+</sup>	Sodium	Cl <sup>-</sup>	Chloride
Mg <sup>2+</sup>	Magnesium	NO <sub>3</sub> <sup>-</sup>	Nitrate
Ba <sup>2+</sup>	Barium	SO <sub>4</sub> <sup>2-</sup>	Sulfate
Pb <sup>2+</sup>	Lead (II)	CrO <sub>4</sub> <sup>2-</sup>	Chromate
Fe <sup>3+</sup>	Iron (III)	PO <sub>4</sub> <sup>3-</sup>	Phosphate

The solubilities of (in water) of compounds made from these ion is is indicated in the table below. A solution of a soluble ionic compound will conduct electricity and is called an **electrolyte**.

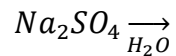
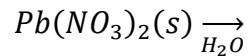
	Cl <sup>-</sup>	NO <sub>3</sub> <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>	CrO <sub>4</sub> <sup>2-</sup>	PO <sub>4</sub> <sup>3-</sup>
Na <sup>+</sup>	Soluble, colorless	Soluble, colorless	Soluble, colorless	Soluble, yellow	Soluble, colorless
Mg <sup>2+</sup>	Soluble, colorless	Soluble, colorless	Soluble, colorless	Soluble, yellow	Insoluble, white solid
Ba <sup>2+</sup>	Soluble, colorless	Soluble, colorless	Insoluble, white solid	Insoluble, yellow solid	Insoluble, white solid
Pb <sup>2+</sup>	Insoluble, white solid	Soluble, colorless	Insoluble, white solid	Insoluble, yellow solid	Insoluble, white solid
Fe <sup>3+</sup>	Soluble, orange	Soluble, orange	Soluble, orange	Soluble*, deep orange	Insoluble, yellow solid

\*Forms Fe<sub>2</sub>(Cr<sub>2</sub>O<sub>7</sub>)<sub>3</sub> in solution.

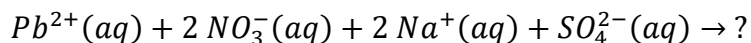
1. Write net ionic reactions for the formation of a solution from the following compounds:



2. Write net ionic reactions for the formation of solutions from the following solids:



Predict what will happen if the above solutions are mixed:



Write a net ionic reaction based on your prediction above. Remember to

- Exclude any ions that do not undergo any chemical changes
- Simplify to the smallest whole number coefficients that will balance the net ionic reaction.

## Exp 24 – Conductivity and Electrolytes – Report Form

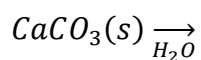
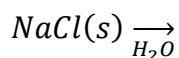
Name \_\_\_\_\_ Date \_\_\_\_\_

Lab Partner(s) \_\_\_\_\_

### Part A - Conductivity

Substance(s)	Conductivity
Water	
NaCl(s)	
CaCO <sub>3</sub> (s)	
Water + NaCl	
Water + CaCO <sub>3</sub>	

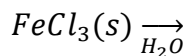
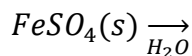
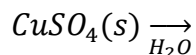
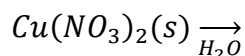
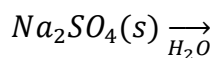
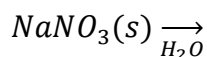
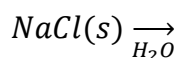
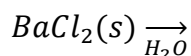
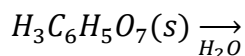
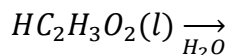
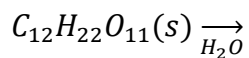
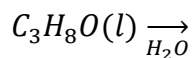
Based on your observations, write net ionic reactions for the following:



### Part B – Conductivity of Solutions

Solute	Conductivity	Categorization
Isopropyl alcohol		
Sucrose		
Acetic Acid		
Citric Acid		
Barium chloride		
Sodium chloride		
Sodium nitrate		
Sodium sulfate		
Copper (II) nitrate		
Copper (II) sulfate		
Iron (II) sulfate		
Iron (III) chloride		

## Reactions



## Part C – Conductivity and Chemical Reactions

Solution(s)	Conductivity
2.0 mL 0.010 M Ba(OH) <sub>2</sub>	
2.0 mL 0.010 M H <sub>2</sub> SO <sub>4</sub>	
2.0 mL 0.010 M Ba(OH) <sub>2</sub> + 2.0 mL 0.010 M H <sub>2</sub> SO <sub>4</sub>	

Based on your observations, indicate the net ionic reaction below:

