Chem1311Ch4Ep2 Transcript

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Hello and welcome to the second episode of reactions in aqueous solutions.

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Previously in reactions he made clear solutions.

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We learned the difference between strong electrolytes and weak electrolytes.

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And also non-electrolytes.

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We discussed the reason why ionic compounds dissociate in water.

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We learned the identity of the seven strong acids.

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And we memorized it, didn't we?

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And we learned that aqueous solutions can be classified into eight types.

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In today's episode.

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We will learn to recognize precipitation reactions.

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We will learn to write ionic and net ionic equations.

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And we will.

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Learn to tell whether a double displacement reaction.

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Will take place or not.

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The first type of reaction is the precipitation reaction.

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You may remember from the previous episode diagram that this is one of the three types of double displacement reactions.

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A precipitate is the name we use for an insoluble solid that separates from solution during a chemical reaction.

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In this example, we have the precipitation reaction between lead 2 nitrate and sodium iodide.

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The precipitate is easily recognizable because it is labeled as a solid product.

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Also notice that there is no solid on the reactant side.

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If there were solid there, this reaction would not be a precipitation reaction.

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This reaction fits under the double displacement designation because the two cations and anions change partners.

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Lead ends up with iodide.

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And sodium ends up with nitrate.

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This way of writing an equation, the only one you've learned so far is called the molecular equation.

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And the irony does not escape me.

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I do know there are no molecules in this molecular equation.

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It's just what it's called.

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Another way to write the equation for this reaction.

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It's called the Ionic equation.

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Notice that the lead (II) nitrate is written as the ions that make it up.

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Because it is aqueous.

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Lead (II) nitrate is made up of 1 mole of lead (II) ions.

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And two moles of nitrate ions.

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Likewise, the two moles of sodium iodide.

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Are written as two moles of sodium.

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And two moles of iodide.

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Because it is aqueous.

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Also, the two moles of sodium nitrate are in turn made up of two moles of sodium.

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And two moles of nitrate.

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The solid lead (II) iodide is written together.

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Because it is not aqueous.

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And therefore, it does not separate into ions.

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This is an important principle to follow.

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Solids, liquids and gases will not be separated into ions.

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Notice that some ions, like nitrate, appear on both sides of the Ionic equation.

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These ions are not changing at all in this reaction, they're just watching.

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If we cancel these ions, called the spectator ions.

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We will call the result our net Ionic equation.

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Those are the three types of equations that you will be writing down.

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Molecular, ionic, and net ionic.

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Here is the rationale for writing net Ionic equations.

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This is the same reaction by the way.

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Notice that on the left you initially have all ions surrounded by water molecules and not interacting with each other at all.

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However, when lead and iodide, ions encounter each other, they begin to form a crystal and push out the water molecules.

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That's the middle frame.

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That is all that is happening.

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So the net Ionic equation describes what is happening best.

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In order to decide if a precipitation reaction takes place or not.

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It is essential to become familiar with this solubility rules and how to apply them to an example equation.

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Please print this list of rules from canvas.

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The first rule states that all compounds.

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Containing Group 1 metals or ammonia are soluble without any exception.

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The second rule states that compounds containing nitrate.

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Acetate, bicarbonate, chlorate and perchlorate.

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Are also soluble without exception.

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These two first rules trump the others and never contradict each other.

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The third one and fourth rule.

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Show that most halides and sulphates are soluble.

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But they do have some exceptions.

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The 5th and 6th rules list anions which form insoluble compounds with also a few exceptions.

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You'll notice that I added the state of matter designation because the S means solid and not soluble.

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And believe it or not, that confuses students sometimes.

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(aq) is what means soluble.

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(aq), soluble, (s), insoluble.

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In the laboratory, beginning students are sometimes unsure when they are seeing a precipitate.

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If the solution is at all cloudy, it is a precipitate, whether it settles to.

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The bottom or not.

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Here are some examples of precipitates formed by insoluble compounds.

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Get your printed copy of the solubility rules and we are going to determine if the following are solids.

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Or aqueous.

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Start by looking for a rule concerning sulfate. We're working example a.

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Even though sulfates are usually aqueous.

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Silver is listed as an exception.

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Therefore, this compound is a solid.

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Next, we look for a rule about carbonates.

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We find that carbonates are usually insoluble.

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And calcium is not listed as an exception.

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So this compound is a solid.

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Next, we look for a rule about phosphates.

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Phosphates are usually insoluble.

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However, sodium is listed as an exception.

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And therefore, this compound is aqueous.

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You will be called on to write net ionic equations and your textbook gives the following steps to follow.

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However, you will be much more successful if you break down that first step into 3 sub steps.

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Small steps.

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The most important piece of advice is do not try to balance the equation before you have written down the correct formulas.

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This is where the vast majority of mistakes takes place.

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Like most of chemistry, the best way to learn the process is by using it on several examples.

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We are given 2 reactants in this example, so we write down their formulas.

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Making sure that the total.

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Positive charges match the total negative charges.

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Potassium is a plus One phosphate has a negative 3, so we have three potassiums and one phosphate.

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Calcium has two positive charges.

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Nitrate has one negative charge, so we have one calcium and two nitrates.

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Just like you did in Chapter 2.

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Next, we pair up the cation of 1 compound with the anion of the other.

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So, potassium and nitrate end up together.

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To form potassium nitrate.

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And calcium and phosphate end up together.

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To form calcium phosphate.

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Please notice that we don't care what quantity of each ion.

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Was present on the reactant side.

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We don't care right now.

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Not yet.

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We'll care later.

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Next, we check the solubility rules for each one of these compounds and hope for a solid product.

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If you do have a solid product, great.

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Next, we balance the equation.

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If you have trouble with balancing, review the Chapter 3 video on balancing equations. For the sake of time efficiency.

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I will not be reviewing how the equation is balanced in this unit.

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Next thing is.

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We will write all the aqueous compounds as the ions that make them up.

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But not the solid.

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The solid stays together.

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Next, we cancel all the spectator ions.

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Potassium and nitrate.

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And what is left is the net Ionic equation.

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Let's now predict what happens with magnesium nitrate.

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And sodium chloride.

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As before, we start by writing down the reactants we are given, making sure to get the formula right.

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Magnesium +2 nitrate negative one. You get the idea.

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We are going to pair up the cations with the opposite anion.

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And we write the formulas for magnesium chloride and sodium nitrate.

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Next, we check the solubility rules.

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And we are left wondering what happens when products are both aqueous.

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Nothing happens, literally nothing happens.

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There is essentially no reaction taking place.

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There is no precipitation without a precipitate.

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Now let's predict the reaction for barium chloride.

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And sodium sulfate.

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We write the correct formulas for both reactants.

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We then pair up the cation with the opposite anion.

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And we write down their formulas based on the charges they have.

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We follow the solubility rules to determine if we have a solid product.

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And we do.

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And then we balance the equation.

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That's our molecular equation.

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For our ionic equation.

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We separate all the aqueous compounds into the ions that make them up.

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But we leave together the solid.

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We then look for and cancel all our spectator ions.

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And what is left,

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Is the net Ionic equation.

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The skill you have learned to write ionic and net ionic equations will transfer to three other types of equations.

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Acid base neutralization.

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Neutralization with gas evolution.

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And the single displacement reactions.

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So it is important that you practice it.

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So you become very proficient with it.

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And that's all there is.

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There isn't any more.