>> Diane Jewell: What will happen if we mixed sodium chloride and lead nitrate in solution? Well, let's take a look at each one. Here we have sodium chloride. If we put sodium chloride in water, what we would end up with would be sodium ion, aqueous, and a chloride ion, aqueous, okay, because sodium chloride is soluble in water. Any substance that has a sodium, a lithium, or a potassium, in other words a group 1A element in it, will be water-soluble. Okay. Now let's see what happens over here. We have lead nitrate. Lead will become lead 2 plus and that will be aqueous when we put it in water. The NO2, subscript 2, that subscript becomes a coefficient. Now we're going to have two nitrates again as aqueous ions, okay, because any substance that has NO3 in it will automatically be soluble in water. So this is soluble and this is a soluble salt. Both of them are soluble salts. What happens now when we put them together though? We're going to see that – we're going to see a double replacement happening where sodium now will come together with nitrate and lead will come together with the chloride ion. Okay. Well, what can we expect from that now? So if sodium and nitrate come together, they would form sodium nitrate. Would sodium nitrate be soluble, though, or would it stay as ions in solution? Well, we already said that anything that has sodium is going to be water-soluble. We also said anything that has a nitrate is going to be water-soluble. So when sodium and nitrate come together, they're not really going to come together because in order to come together they would have to actually form a compound. But these are going to stay separated in aqueous solution because they are water-soluble. Okay. So now let's look at the other possibility. We have lead and we have chloride. When lead and chloride get together, the two of them form an insoluble salt called lead chloride. And so what we're going to see now is this will stay in solution and this will stay in solution, but the lead chloride will form a solid and that will precipitate out a solution. How do we write this as a reaction now? Well, we've got our sodium plus, aqueous, and chloride, aqueous, plus our lead, lead is a 2 plus, aqueous, and two nitrates, aqueous. Those are all the reactants going to lead, aqueous, and – I'm sorry. Sodium, aqueous, and lead chloride, solid. Here's what's going be insoluble in water and two nitrates, aqueous. Now is that a balanced equation? It isn't, is it, because in order for chlorine to bond with lead, you notice lead has a 2 plus which means we have to have two chlorines, two chloride ions to come together with that. So that means we have to have two chloride ions in the beginning. So if I come back over here – if I've got to have two chlorides – well, the only way I could have two chlorides is if I have two molecules of sodium chlorine, sodium chloride. And so that means I've got two sodiums too. So let me go ahead and put two sodiums here plus two chlorines. Okay. Well, now sodium isn't balanced on the other side because we have one sodium in our product. So we have two sodiums as a reactant, two sodiums as products so now the sodiums will match. There's two chlorines. There's one lead. And this was already two each. So now we've got a balanced equation. This is called our complete net, I'm sorry, our complete ionic equation. Okay. And you see everything starts out as ions. Everything is aqueous. That's a complete ionic equation. What you have down here is something that's a lot shorter. This is the net ionic equation.

Now what's the difference between the two? Well, what we want to do is go into the complete ionic equation and say what are our spectator ions? A spectator is somebody who comes and watches something. You can be a spectator in sports. You can be a spectator at the theater. You can – and some of these chemicals are acting like spectators. They're not getting involved. They're just watching. So they come and then they leave in the same way that they come. In other words, sodium comes as a positively charged aqueous ion. At the end, what is it? It's a positively charged aqueous ion so it didn't change at all which makes sodium a spectator ion. Let's go ahead and put that si, spectator ion. Okay. Chlorine. Does chloride end up being chloride at the end? Well, no it doesn't. Actually chloride ends up becoming part of the solid, so this is reacting. Lead becomes part of the solid. That reacted. Nitrate. Nitrate has a negative charge. It's aqueous. Look what we have in the product: nitrate, negative charge, aqueous. That didn't change at all so, again, this is a spectator ion. Now when we write our net ionic equation, we want to get rid of those spectator ions. So this will be gone and this – let's see. This is going to be gone and this will be gone and all we have left now is our lead plus our two chlorides giving us lead chloride and that's what you see down here. Lead 2 plus, aqueous, and two chloride, aqueous, giving us PbCl2, solid. Very important when you're working with ionic equations to indicate the states that each one of those components are in. So you want to make sure you go back and check and make sure every one of these has some indication of what state it's in, whether it's aqueous or whether it's a solid.