>> Diane Jewell: When we work with ionic charges, we can get those ionic charges right off the periodic table. Elements that are in the 1A group will form a plus 1 charge. Group 2A elements form a 2 plus charge. 3A form a 3 plus charge. Okay. Now you'll notice I put an X here for 4. In order for the 4A elements to form a charge, they would either have to acquire 4 electrons or they would have to give up 4 electrons, and it takes a lot of energy to either give up or take on electrons like that. That would really be too much energy. So you wouldn't see that happening. So 4A elements do not form charge electrons. Or, I'm sorry, charged ions. Group 5A will make a 3 minus ion. Group 6A elements form a 2 minus ion. And group 7A form a 1 minus ion. Okay? And then again you'll see 8A doesn't form any ions because 8A has what everybody else wants which is an octet. So these don't have to gain or lose electrons to become what they already are. Everybody wants to be a noble gas. Okay? Wannabes. Okay. So what happens then when we have to write a compound, and write the formula of a compound? We need to know what these charges are in order to get those ionic compounds correct. If I bring together sodium and chlorine, and just look at the red. Sodium is in red. Chlorine is in red. How do I figure out how to put those together? Well, what I want to do is I want to go ahead and put in those charges. Sodium comes from 1A so it's got a 1 plus charge. Chlorine comes from the group 7A so it has a 1 minus charge. Notice these are equal in magnitude to each other. It has a magnitude of 1 here, and a magnitude of 1 here. Okay? Just regarding the charges. Because it's a 1 to 1 magnitude like that, they balance each other out perfectly. 1 sodium and 1 chlorine will balance each other out to end up with a net charge of 0. And that's what we're doing when we put elements together to form a compound. We want them to have a net charge of 0. Since they already take care of each other and cancel each other out, then we're just going to put them down as NaCl. There actually is a subscript 1 for each of these elements in here, but we don't write that because whenever you have the one, you just leave it out and it's assumed that where you left out the number, it's a number one. So this is sodium chloride in a 1 to 1 ratio. Now look at what we have here. Magnesium and oxygen. Magnesium comes from group 2A so it's got the 2 plus. Oxygen comes from group 6A so it has the 2 minus. Again, look at the magnitudes. They're equal. Both of them are opposite in charge, but they both have a magnitude of 2 which means when we add them together, 2 plus 2 – and minus 2. They equal 0. And again they cancel each other out, making the perfect compound in a 1 to 1 ratio. So again we're going to write it as MGO. We're implying that there's subscripts 1 and 1 here because they're not written. So it's simply MGO. Notice it's not going to be MG2O2. It's MGO. To have two subscripts that can actually be divided down by a common number would make the answer wrong. So if you had MG2O2, that would be considered wrong because if it's a 2 to 2 ratio it's also a 1 to 1 ratio. We want the smallest ratio possible in our subscripts. Okay? Third example. Aluminum nitrogen. Aluminum comes from group 3A. Nitrogen comes from 5A. So it's got the negative 3. And again these are perfect matches because they're negative and positive charge, they're opposite charges, but they have the same magnitude, the magnitude 3. They cancel out. One of these

will cancel out one of these. And therefore we write the formula ALN. Again, the subscripts would be 1 and 1 which we leave off. Okay? So those are the nice user friendly ones that come with charges that just automatically balance each other out. But, you know, we have a lot of other compounds that don't do that. So let's take a look at those next. What about if I said, "Let's put some sodium together with some sulfur?" Okay. Now what you see in black here, that's your job. If I gave you this problem, I would just give you sodium and sulfur. It would be up to you now to say, "Sodium. Okay. Sodium is 1A, and here's 1A. That's a plus 1. Sulfur, sulfur is from 6A, and so that's a 2 minus." Okay. And from here now you have to balance that. You can look. Before you do anything else, look and see if the magnitudes are equal. And they're not. 1 does not equal 2. So if I just add those together, plus 1, plus negative 2, I get a negative number, and that means that if I did this in a 1 to 1 ratio it would not be a neutral compound. So that's not how it would form. We have to form it in such a way that these two will balance out, and they'll cancel each other out and form a neutral compound. Easiest way to work this problem is in this – is the way I've got here. What you see here – Let me go ahead and take these off just to kind of show you a little bit easier here. We have sodium. And I've just written sodium. I've taken off the signs. Let's just say – Take the absolute value of the charges. Absolute value of 1 plus is simply 1. So I just wrote sodium with a 1. Absolute value of 2 minus is a 2. So I've written sulfur with a 2. Okay? So now I've taken the absolute values of those charges. Now what I'm going to do is I'm going to cross them over like this. The 2 will go down to the other element as the subscript. And you see it right here. This 1 will go down to the other element as a subscript there. And so now I have 2 sodiums, and 1 sulfur. An A2 S1. Okay? Am I done? Not really because remember we don't leave the 1 there. We just take that off because it's an implied 1. And so when you write sodium sulfide you would write NA2S. Okay? Let's take a look at aluminum and oxygen. Aluminum, again I wouldn't be giving you these numbers. You would have to know these. And so I would give you aluminum and oxygen. You would look on the periodic table and say, "Oh. Okay. Aluminum is under 3A. That's a 3 plus. Oxygen is under 6A. That's a 2 minus." And you would go ahead and put those in. Then you would take the absolute value of each one. So the absolute value of 3 plus is simply 3. Absolute value of 2 minus is simply 2. So now we've got just the absolute values. We're going to do that crisscross again. This one's going to go down, and be the subscript for oxygen. This is going to go down, and be the subscript for aluminum. And so now you have a nice balanced product of Al2O3, and that ends up being a neutral compound. The third one. We have lithium. We have phosphorous. Lithium is a group 1A element so we have the 1 plus. Phosphorous is a group 5A element so we have 3 minus. Okay? Next step, take the absolute value of both of these, and you end up with 1 on lithium and 3 on phosphorous. Okay. Step after that. That crossover. 1 for lithium goes down with phosphorous. 3 with phosphorous goes down with lithium. Last thing to do is check, "Did I leave any ones in there?" Yeah. There's a one here. So I can go ahead and erase that one. And my answer is lithium phosphide. Okay? Li3P. You might say, "Well, how does this work?" Well, let's take a look just for a minute. Okay. If I were to put those charges back in to check, let's just go ahead and do this. This would be 3 plus. And this would be 2 minus. 2 times 3 plus is 6 plus. 3 times 2 minus is 6 minus. Plus 6 and minus 6 added together give you that 0. This system works because, well, I don't know why it does. It just does. So that would be the easiest way to make these – write your formulas.