

>> You react 3.00 moles of H₂, which is your hydrogen and 4.3 moles of Cl₂, which is chlorine. Now which is limiting and which isn't? And how much is in excess? OK, in other words sometimes when you put things together you actually don't use up one of your reactants. One of the reactants may run out before the other one does, in which case the reaction then stops and whatever wasn't reacted from the one you have more of will remain in the system as it was. And so the question is, what's going to run out first? Is it going to be hydrogen or will it be chlorine? So what we have to do is we have to look at these individually. So first off let's look at hydrogen. We're starting with three moles of hydrogen. Now how much chlorine will we react with three moles of hydrogen. In here you can see there's a one to one ratio so there's one mole of chlorine to every one mole of hydrogen. And so we're going to end up using 3.00 moles of chlorine if hydrogen runs out first. Question is do we have at least three moles of chlorine? And the answer is yes, we actually have more than that. We have 4.3. So that's good because hydrogen will be able to be totally used up and we have enough chlorine to use it up. Now let's look at chlorine. Chlorine we start with 4.3 moles. So here's 4.3 moles of chlorine. We have one mole of hydrogen for every one mole of chlorine. So that equals 4.3 moles of hydrogen to be used. Well, in order to use up all that we have to have 4.3 moles of hydrogen. We don't have that much. We only have three, which means that we can't use up all our chlorine. In other words hydrogen is limiting the amount of reaction we can do because we only need three moles of chlorine but we're going to need 4.3 moles of hydrogen, we just don't have it. So hydrogen is what we don't have enough of and therefore hydrogen is our limiting reactant. Now that hydrogen is going to use up three moles of chlorine so the next part of our question was how much of the excess material we have left. We know now that we're going to have chlorine in excess. So how much will that be? Well, excess chlorine equals the number of moles we started with minus the number of moles we can use based on the hydrogen running out. So 4.3 minus 3 gives us 1.3 moles of chlorine left after all the hydrogen is reacted. So now we can take that 1.3 mole of chlorine, using the molar mass of chlorine we can then cancel our moles of chlorine, 1.3 times the 70.9 gives us 92.17 grams of chlorine in excess and I'm looking at that and I'm thinking, you know what? Let's go ahead and just say 92 grams of chlorine in excess so we have the right number of significant figures. So what is our answer? Well we had two answers. The first question was what was limiting? And that's going to be the hydrogen. The second question is how much is going to be in excess of the other material? There's going to be 92 grams of chlorine left in our system that's unreacted. Now this actually, you could have checked, you could have figured out the limiting reactant just by looking at this one because we have a one to one ratio there. So that means one mole of hydrogen reacts with one mole of chlorine. Two moles of hydrogen would react with two moles of chlorine. Three moles of hydrogen would react with three moles of chlorine. And you can see there if it's one to one then to get 4.3 moles to react, I would need more hydrogen than I do. And so just by comparing those you can see that this is going to run out first and then it's just a matter of finishing what you did here to figure out how many moles of chlorine

is left and then converting it to grams of chlorine.