Hello, everybody, I'm recording this video. To help describe the way we want you, we want you to think about bonding in organic molecules. It would be best if you have already read sections 1.6 and 1.7. In the textbook before you see this video, those sections describe the basics of quantum mechanics in quantum mechanics is the mathematical model that predicts the overall electron density locations in molecules. Now, much of what's going on with the quantum mechanical collect calculations are beyond the scope of this class. But we do want you to be able to use the underlying principles to describe bonding in molecules. Because we're going to be worried about bonding we need to worry about two kinds of bonding there are sigma bonds. Those are the cylindrically shaped bonds that are formed from the overlap of two hybrid orbitals on adjacent atoms or in the case of hydrogen, the overlap of a hybrid orbital with the hydrogen, one s orbital. We're also going to be talking about pi bonds. And I don't know any better way to describe this than as being a hot dog bun shaped orbital that is formed from the overlap of parallel on hybridized to people p orbitals. Okay, so let's talk about bonding in a real simple molecule, such as methane. The first thing we need to do is to establish the hybridization state of the central carbon atom. Well, you know how to do that because you look at the number of bonds and the type of bonds that are attached to each atom. So for example, if we have four single bonds to the same carbon, that means it's going to be SP three hybridized. And that also means there are four SP three hybrid orbitals on the carbon atom. If we had seen two single bonds and one double bond to the carbon That means it is sp two hybridized having three SP two hybrid orbitals and one unhybridized two p orbital. If we see one single bond, and one triple bond, or more rarely two double bonds to the same carbon, that would mean that is sp hybridized. And that means that that carbon would have to sp hybrid hybrid orbitals and two unhybridized two p orbitals. Well, let me erase this here. And when you look at this molecule, obviously methane has four single bonds to carbon, and therefore, it is going to be SP three hybridized. That also means there are four, SP three hybrid orbitals on that carbon atom, and those are arranged in a tetrahedral arrangement in three dimensional space. When we think about bonding Then we add the hydrogen atoms. And the one s orbitals on each hydrogen are then going to overlap with those SP three hybrid orbitals on carbon to create the cylindrical sigma bonds. So when we ask you to describe bonding and the methane molecule, we want you to tell us that what we've what we have here is a sigma bond formed by the overlap of the carbon SP three hybrid orbital, and a hydrogen, one s. Now, each of these carbon hydrogen bonds should be described in the same way. Let's look at a slightly more complicated case. Here we've got a different

molecule the same molecule.

And again, we have to establish the hybridization state of each carbon atom. We notice of course, that each carbon atom has to sit bonds and then one double bond, meaning that it is sp two hybridized. So there are going to be three SP two hybrid orbitals, and one unhybridized two p orbital on each carbon.

Okay?

When we draw those,

we see that they're arranged in a roughly trigonal array by 120 degrees between them. And so each carbon has those three different SP two hybrid orbitals, and in the middle, the two SP two hybrid orbitals overlap to create a carbon carbon sigma bond. We can add the hydrogens as before, and we can see an overlap between the carbon SP two hybrid orbital and the hydrogen one NASS, but now because we're dealing with SP two hybridized carbon, we have to consider the unhybridized, two p orbitals on each carbon atom. Those are going to overlap to form a pi bond between the two carbon atoms. So to fully describe bonding and the ethene molecule, what we have is one sigma bond between the two carbon atoms that's formed from the perfect overlap of two SP two hybrid orbitals. We also have a pi bond, which is formed from the overlap of two p unhybridized. Two p orbitals on each carbon atom. We also have the four bonds to hydrogen. That's our sigma bonds formed from the overlap of SP two hybrid orbitals on carbon and the one s orbitals on hydrogen. So I hope this has been helpful, you're going to be asked to describe and even think about organic molecules in this way as the overlap of hybrid orbitals. In the case of sigma bonds, or in the, in the case of pi bonds is the overlap of parallel to p orbitals. And this should help you understand the properties of molecules as we move forward.