PROFESSOR: Hi everyone. Welcome to the biochemistry help sessions. This is the covalent bonds, chirality, electronegativity, and hydrogen bonds module. In this help session, I'll be going over the first practice problem in this module. If you have not had a chance to look over this problem yourself, please go back, look over the problem, try it, and then come back and we'll go through it together.

Now that you've had a chance to look at the problem, let's get started. First of all, what is this molecule? To me, this molecule looks like it's a sugar. It's a polysaccharide, to be exact, and it's actually a chain of glucose molecules. So in this problem, the first part of the problem asks us to name each circled bond in this molecule.

So the first circled bond is right here, and this is a carbon to carbon bond. Now, the first thing that we can notice about this bond is that it's a carbon to carbon bond, and we know that carbon only forms covalent bonds in biological systems. So the first thing we can say is that this bond is a covalent bond. Second, we need to decide if this bond is polar or non polar. And the way we decide that is we look at the electronegativity of the atoms involved.

In this bond we have two carbons. And so since they're the same atoms, we know that they have the same electronegativity. And bonds between two atoms of the same electronegativity are non polar bonds. So we know that this carbon to carbon bond is covalent and non polar.

Now we'll look at the second bond circled. This bond is a carbon to oxygen bond. It is similar to the first bond in that it involves carbon, so we can say that it is a covalent bond. What's different about this bond, however, is that it is a carbon bound to an oxygen. And when you look at the electronegativities of carbon and oxygen, you find that oxygen is much more electronegative than carbon.

So in a carbon to oxygen bond, you actually have oxygen is greedy, and it's going to take the electrons closer to itself and not share them equally with the carbon. So in this kind of bond, oxygen will be slightly negative and carbon will be slightly positive, because the electrons are attracted closer to the oxygen. In a bond where you have a slightly negative side and a slightly positive side, we call this a polar bond. So we can say that a carbon to oxygen bond is a polar bond. So in this first part, we learned that the difference between a covalent and a non polar and a covalent polar bond.

The second part of the problem, part B, asks if this sugar molecule is soluble in water. So first you need to know whether this molecule is polar or non polar. And since we know that it has carbon to oxygen bonds, we know that it has polar bonds, so it is a polar molecule.

And what do we know about water? We know water is an oxygen bound to two hydrogens. And since it has this very electronegative oxygen, we know that it is also a polar molecule.

And an easy rule of thumb is that like dissolves like. So since these are both polar molecules, sugar dissolves very easily in water. If you had a fat, on the other hand, which is a non polar molecule, it would not dissolve in water. That's why when you put oil and water, you don't see it dissolve.

So now that we understand why sugar dissolves very easily in water, we'll move into the third part of the problem, where they ask what types of bonds can form between these long polymers. So looking at these polymers, the first thing that we can notice is that there are these oxygens and hydrogens on each of the polymers. And looking at these, we can see how you can have hydrogen bonding, which we learned about in class, between the oxygen of one sugar molecule to the hydrogen of another sugar molecule, thus forming hydrogen bonding networks between the sugar molecules. And in this way, they can interact with each other.

So in this help session we have covered the difference between a covalent non polar bond and a covalent polar bond. We have covered why water can dissolve sugar very easily, and what kind of bonds can form between these two sugar molecules. Thank you.