

PROFESSOR: Hi, my name is Nicole and welcome to recitation. Today we are going to go over the practice problem for the nucleic acids, carbohydrates, and lipids section of the biochemistry module. First, if you haven't had a chance to look at this problem, please go back and look at it and then come back to recitation and we'll go over it together.

Welcome back. To start this problem, we are going to go through parts A through D and then we'll take a break and come back and do parts E and F.

So, this problem asks us about the molecule shown here. First, we are asked to name this molecule. By looking at this molecule, it's really easy to figure out what it is. All you have to do is notice the fatty acid tail and the phosphate head. If you remember from lecture, this should tell you that it is a phospholipid.

Next, we are asked where we find these molecules in living cells and what the function of these molecules is. So if you remember from lecture, we are told that we find these molecules in cell membranes. We learned that they are an integral part of cell membranes and their function is to control the permeability of the cell, which is a very important function.

Their structure allows them to keep out polar molecules and let in nonpolar molecules so they can allow the cell to have a high solute concentration on the inside as compared to the outside. So their critical function is to form a permeability barrier on the cell.

So now that we understand what the function of these molecules is, this question asks us what would happen if we dropped these molecules into a glass of water. So sometimes these molecules are drawn like this, with a circle as the phosphate head and two squiggly lines as the tail.

So if we dropped these in water, we can get three possibilities. Either they can form a micelle, which is drawn with all of the heads towards the outside, facing the water molecules and the tails all hidden on the inside.

Or, it can form a liposome, which is two layers with a very tight layer of phospholipids on the inside and a larger layer of phospholipids on the outside with the tails facing inwards and the heads facing outwards towards the water. And there is also water in the middle as well facing these nonpolar-- I mean, these polar heads.

The third structure they can form is a bilayer. This is a structure that is found that makes cell membranes, is this phospholipid bilayer. So this is actually a much larger structure-- I've only drawn part of it here-- and this is where you have water on both sides of it. So you have water molecules out here and on the inside of the bilayer. So those are the three molecules that-- three structures that this molecule will form when you drop it into water.

Now the most important part of this problem is asking why do these molecules form these structures when dropped into water. And we can find the answer to this very easily in just looking at the properties of phospholipids and the properties of water. If you look at a phospholipid, you'll see that the head, the phosphate head, is negatively charged, so that means that it's polar, whereas the tail is a fatty acid, and we have learned that that means that it is nonpolar, because it has no charge.

And if you look at water, water is a polar molecule as well. It has two polar bonds to hydrogen.

And the reason that they form these structures is because the polar heads of the phospholipids want to interact with polar water and the nonpolar tails of the phospholipids do not want to interact with the polar water. So they have to find the confirmations in which the tails are hidden from water and the heads are exposed to water.

So now that we understand why phospholipids form these structures, we're going to take a break and come back to the second part of the problem.

Welcome back. Now we are going to solve parts E and F of this problem. Part E asks us to draw another molecule that contains phosphate that is essential to

biological systems.

Right off, you should be thinking about nucleic acids. I have written an example of a nucleic acid up here. This, as you can see by the A in the base position, is ATP. And you can see where phosphate is essential as the triphosphate portion of ATP.

The next part of the question asks us what is the function of these type of molecules? So the molecule that I chose to draw, ATP, is very interesting because it has multiple functions. It serves as a building block of RNA through oligomerization through this bond by adding multiple nucleic acids together.

It also serves as an energy source for the cell, the energy source for the cell, through breaking of this bond, which is an exergonic reaction and releases energy and allows a lot of the processes in the cell that wouldn't normally be able to occur to occur. So I'm going to put as a function of this molecule as both energy and RNA.

So now that we understand the properties of phospholipids and we've been able to identify another very important molecule that contains phosphate, we can move on to the rest of the biochemistry section.

In this problem, we have learned about the properties of phospholipids as well as the importance of phosphate in nucleic acids. I hope you've enjoyed watching this video and I hope to see you next time.