SHAWN: OK. Good morning, everyone. Welcome to the recitation section of 10.213. This is the agenda for today. So first of all, we will review the concept of the physical state of a substance. And secondly, we're going to talk about phase diagramming.

First of all, the physical state is a state that a molecule can exist in reality. So take water as an example. Water can exist as gas, liquid, and--

STUDENTS: Solid.

SHAWN: Solid. Correct. So a phase diagram is a tool for engineers or scientists to interpret or very easily identify the physical state at a certain temperature and pressure. So we have this diagram. And on the horizontal axis is temperature, with a unit of Celsius. And on the vertical axis, we have pressure, with a unit of pascals. OK?

As we just talked about, we have three different states of water exist in this diagram. At high temperature-- this is the high-temperature phase-- low pressure, water will exist as--

STUDENTS: Gas.

SHAWN: Correct. So this is the gas state. And at low temperature, high pressure, what do we exist as?

STUDENTS: Solid.

SHAWN: Solid? Great. And at moderate temperature and pressure, water will exist as liquid. That's what we usually see in reality.

And there are a lot of-- there are some-- sorry. Some of the components in this phase diagram you have to identify the physical state of the matter and also when they transform from one state to another. So we have three different lines here. So each line represents a certain condition that two phases can coexist.

So for example, at 100 Celsius and 101.325 kilopascals-- so at this specific pressure and temperature, water can exist as gas and liquid simultaneously. So far, so clear? OK.

And there's an intersecting point of these three lines. This intersecting point is called a triple point. At this triple point, we have three phases coexist. So solid, liquid, and gas can exist at this specific pressure and temperature.

OK. So now there's a question. Supposedly you're on the mountain of Himalaya and then you know the pressure is slightly lower than 1 atmosphere, which is less than 1.1 kilopascal. My question is, is the water going to boil at 100 Celsius? Or is it going to boil below or above 100 Celsius? Anyone that volunteer a guess? Melissa?

STUDENTS: It would be below 100 Celsius.

SHAWN: OK. Why?

STUDENTS: Because if you're at a lower pressure, you'll intersect the coexistence line between liquid and gas at a lower temperature.

SHAWN: Correct. Excellent. Does anyone follow her? OK. Great.

So let me just wrap up today's lesson. We first reviewed the physical state of water. Water can exist as liquid, solid, and gas depending on the temperature and pressure.

And then we drew the phase diagram of water. And there are three different elements there, which you'll remember. First, in each space, you have the phase of water. And then we have the coexisting lines, which is the lines that water can exist as two different phases simultaneously. And then we have the triple point, where three different phases can coexist.

OK. Any questions for today? OK. So this is for today.

Next time, we will talk about phase diagrams of a mixture. For example, if you add sodium chloride, which is salt, in water, how does the phase diagram of water change? If you want to know that, definitely come to our next recitation section. Thank you.