Thermodynamics
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Lecture - 12
Laws Of Thermodynamics: Zeroth Law

And now we go on to the laws of Thermodynamics.

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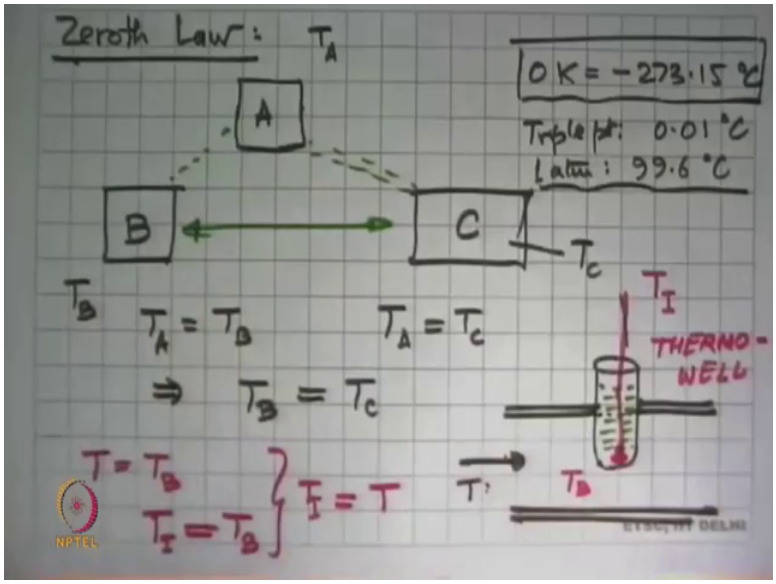

Beginning with the zeroth law, with states that if there is a body the system A and there is another body B and this has a temperature T A; that means, this is in equilibrium. And this has a temperature T B; that means, this is also in equilibrium. So, then if T A is equal to T B and there is a third body C with temperature is T C and if T A is equal to T C; that means, the temperatures are equal then the law says that temperature of B is equal to temperature of C.

That if two bodies have the same temperature with one another and with another body separately then these two have the same temperature. It sounds quite obvious, it helps us in defining a temperature scale and in many cases we exploit this principle unknowingly in making temperature measurements.

I have given example on that, if there is a steam or hot substance or an acid or something like that showing through a pipe and you want to measure its temperature we cannot just

stick something into it, especially a mercury thermometer and what to get a value. So, what one does is to drill a hole and build a pipe which is closed at one end and in the wall of the tube and this is all welded around.

So, this is a tube welded into this pipe into which the substance is flowing, its temperature is say T and we want to measure it. And so what we do is we took a sensor into this and this could be any of this type of sensor that we have. Say resistance temperature detector, it could be here or it could be in contact with this inside surface of this tube and this little thing is filled with a liquid.

And what we measure is from this instrument in that temperature of this part of this instrument, which we will call say T I, say temperature of the instrument. And we say that this temperature is equal to the temperature of this tube, which in turn is equal to the temperature T.

So, that t the temperature is T B, then we say that we know that T is equal to T B and I measuring T I which is equal to T B and so my instrument is giving me the temperature of the fluid. This type of an arrangement is very very common, you will see it everywhere and this is called a thermo well and that is where we have used the zeroth law of thermodynamics.

With this we also define a temperature scale that also comes little later on, where the acceptor temperature scale now is that absolute 0 is minus 273.15 degree Celsius. And historically there have been two set points one needs to be the triple point of water, will learn that little later which is 0.01 degree Celsius. A temperature at which liquid vapor and solid water can exists in equilibrium and at ambient condition 1 atmosphere, the boiling point of water net is 99.6 degree Celsius and then we divide these.

So, we use the absolute scale of temperature which basically tells us that when a substance goes to 0 Kelvin it has no energy and so we associate 0 with that energy and 0 with its temperature. That becomes a absolute temperature scale and one can when is 1 by 273.15 or the triple point of water, that what it is.