Welcome students, I am miss Angela Rhalima Serrao from Saint Joseph Vaz College, Assistant Professor in chemistry. This is Semester 3 Paper code CHC 103 under the Paper title Physical Chemistry and Organic Chemistry. I'm going to cover the module that is vapour pressure-composition and temperature-composition curves of non-ideal solutions along with what are known as Azeotropes. The module number is 6.

Let us just have a look at the outline of this presentation. Ok, the first one. The first thing we're going to cover is vapour pressure-composition curves of non-ideal solution. The next thing which I will cover is temperature-composition curves of non-ideal solution and the final thing which I will cover is Azeotropes and the types of Azeotropes. Now what are the students going to learn from this particular topic at the end of the session, the students are expected to illustrate the variation of vapour pressure with composition and the variation of temperature with composition. Secondly, the students will be able to differentiate between minimum boiling point and maximum boiling point azeotropes.

Now, we will go into our main topic. Let's just have a look at what the previous person has done for us. Ok, in the previous session we have seen how the vapour pressure-composition curves look like for an ideal solution. So now let us get into our topic that is vapour pressure-composition curves for non ideal solution. They are of three types that is: Type I, those in which the total vapour pressure is intermediate between those of the pure components and do not show any maximum or minimum. Type II, those which show a maximum in the total vapour pressure curve and Type III, those which show a minimum in the total vapour pressure curve. Let us have a look at the type I vapour pressure-composition curve, as can be seen in the diagram normally it is the vapour pressure of component A and component B respectively. As can be seen in the diagram vapour pressure of B is higher than vapour pressure of A, so it implies that component B is more volatile than component A corresponding to composition of the liquid phase, vapour phase will be richer in component B, that is corresponding to composition. Moving on to type II of the vapour pressure-composition curve. As can be seen in the diagram, again, vapour pressure of point B is higher than vapour pressure of A, which implies that component B is more volatile than component A. Now up to point C, as can be seen in the diagram the behavior is the same as type I type of curve. Ok, that is, if you take any composition on the liquid phase, the corresponding composition on the vapour phase will be richer and after point C the vapour phase is richer in component A as can be seen from point c & c’. Point C has the same composition of the liquid and the vapour phase. Moving onto the Type III curve again, as can be seen from the diagram, vapour pressure of B is higher than A, which implies that the component B is more volatile than component A. Now at Point D, the liquid phase and the vapour phase have the same composition, while after point D the behavior is similar to type I as can be seen from points. d, d’, e and e’. That is after point D if you take a point to say point e and if you correspond that particular point to point e’, that will be component B.

Moving on to the temperature-composition curves for non-ideal solutions. Again, there are three types. Type I, those in which the total vapour pressure is intermediate between those of the pure components and which do not show any maximum or minimum. Type II, those which show a maximum in the total vapour pressure. Type III, those which show a minimum in the total vapour pressure. Moving on to type I. As can be seen in the diagram, T_A and T_B are the individual boiling points of pure components A and B respectively. Now if you look carefully in the diagram, T_B is lower than T_A, which means that the boiling point of component B is lower than the boiling point of component A, which also implies that since T_B of the component B is having a lower boiling point, it has high vapour pressure, so it again means that component B is more volatile than component A. Next is type II. As can be seen in the diagram, component B is again having a lower boiling point as compared to component A. Now at Point C, the liquid and the vapour phase have the same composition and point C has the maximum vapour pressure. It also has the lowest boiling point as compared to the individual pure components. Moving on to type III.

We can see in the diagram that component B is again having low boiling point as compared to component A, which implies that component B is more volatile than component A. Now at point D, point D records the highest boiling point, which implies that it has the lowest vapour pressure. Now at point D, the liquid and the vapour phase have the same composition.

Let's just have a look at azeotropes. What are these azeotropes? They are mixtures of liquids which boil at constant temperature like a pure liquid such that the distillate has the same composition as that of the liquid mixture. An azeotrope is formed when the liquid and the vapour components are the same. When the azeotropic composition has been reached distillation cannot separate the two liquids. They are of two types. Minimum boiling point azeotropes and maximum boiling point azeotropes. Let us just first have a look at the minimum boiling point azeotropes. The minimum boiling point azeotropes, they are formed by liquid pairs which show a positive deviation from the ideal behavior. For such azeotropes the boiling point, as you can see at point M, the boiling point is lower than the boiling point of the pure components A & B respectively. Example of such a system is ethyl alcohol and water. Ethyl alcohol boils at 78.3°C while water boils at 100°C. But the mixture boils at 78.13°C. Moving on to the maximum boiling point azeotropes. Now these type of azeotropes are formed by liquid pairs that show negative deviations from the ideal behavior. Now, as can be seen from the diagram, the boiling point of the mixture is higher than either of the pure components. That is, at point M, the boiling point is higher than the individual pure components respectively. Example of such a system is water and hydrochloric acid. Water boils at 100°C and HCl boils at -85°C while the mixture boils at 108.5°C. Let us just just differentiate between the minimum boiling azeotrope and the maximum boiling azeotropes. As I've said in the previous slides, minimum boiling azeotropes, they are formed out of the liquid pairs from the positive deviation of ideal behavior while maximum boiling azeotropes are formed out of the liquid pairs which show negative deviation from the ideal behavior. Now coming to the minimum boiling azeotropes, the boiling points are lower as compared to the individual components respectively, while in case of maximum boiling azeotropes, the boiling points are higher than the individual pure components respectively. Example of minimum boiling azeotropes is ethyl alcohol and water system while that of boiling azeotropes is water and hydrochloric acid system.

These are my references.

Thank you.