

Welcome students program, which I'm going to take is S.Y.B.Sc.

Subject is chemistry, semester III. The paper code is CHC 103.

The paper title is physical chemistry and organic chemistry.

The unit name, that is solutions. The module which I'm taking is

basically non ideal solutions and deviations from Raoult's law.

It is actually model number 4.

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The basic outline of my topic is non ideal solutions and deviations

of non ideal solutions from Raoult's law.

The learning outcome that is the students will be

able to define what are non ideal solutions and the

deviation of the non ideal solutions from Raoult's law

Now, we actually see non ideal solutions. If you take 2 liquids

that is G & H. Here we have considered the liquid, says

G and H. You may consider A & B and so on.

These liquids are mixed. The Solution which is obtained it

does not obey Raoult's law. Then It is termed as non ideal

solutions. That is the interaction of the molecules of the liquid

G and the liquid H in the solution are not similar to the

interaction of the molecules of the pure liquid G and the pure

liquid H. That is, when we mix the solution, that is the change

in volume ΔV of mixture is not equal to 0 and also the change in enthalpy that is ΔH is also not equal to Zero.

The examples of non ideal solutions are water -sulfuric acid, water- nitric acid, water - ethanol, etc. If you actually go to see Raoult's law states that the vapor pressure of a component in a solution. In this case it is the P_G component is equal to the mole fraction of the G component into the vapor pressure of the pure component of the liquid G that is present. So in case of solutions which do not obey Raoult's law are basically termed as non ideal solutions. Now we actually go to see the deviations of non ideal solutions from Raoult's law. So when a graph is plotted of vapor pressure of the solution, versus composition or that is the mole fraction is plotted.

There are three types of curves which are obtained. We have type I on whether the curve shows a small positive deviation. You have type II whether the curve shows a large positive deviation you have type III with a curve shows a negative deviation and then we see the curves. We also see the dotted straight line, which indicates the ideal solutions of the mixture of the solutions which is present. In the first case, that is type I, we have a vapour pressure versus composition, which shows a small positive deviation. Now here if

you see on the X axis that is the mole fraction which is present of H and on this side you can see that of G, it can be seen that the mole fraction of H, it starts from zero. Correspondingly, the mole fraction of G is equal to 1. Hence, if we go from left to right, there is an increasing mole fraction of the component or the liquid H, whereas if you go from right to left, there is an increasing composition of the component that is G.

So XG, that is, the mole fraction begins from zero to one.

That is, when we go from right to left on the X axis we have the mole fraction and on the Y axis we have the vapor pressure.

In case of vapor pressure, if you see on the left hand side it is the vapor pressure of the pure liquid that is G on the right side it is vapor pressure of the pure liquid H. Now in this figure,

if you see the dotted straight lines indicate the ideal behavior, if you see it is shown in actually the green dotted lines that shows the ideal behavior, and above that the curve which shows a slight positive increase that is the positive deviation.

That is the vapor pressure of this solution is slightly more than that of the ideal solutions. So if you see the first curve which is obtained here from the right to the left side, which goes in the decreasing order. That is for actually the vapor pressure of the

liquid component. That is on the right side you have the vapor pressure of the liquid component that is H. So that line or that curve is obtained and if you see the H value is on top which is obtained, that would give us the vapor pressure of the solution which is obtained. So the curves are basically for non ideal solutions. Examples are benzene - toluene, water- methyl alcohol, carbon tetrachloride -cyclohexane. Now if you go to the next group that is Type II, that is the plot of vapor pressure versus composition shows a large positive deviation. In this case, also, if you see the X component is the mole fraction of H. Here again from left to right there is an increasing order values of the mole fraction of H, from right to left it is an increasing order of the mole fraction of the liquid component that is G. The vapor pressure of this solution is more than the ideal solutions. The ideal solutions indicated by the dotted straight lines, non ideal solutions are the curves which we see. You can see there is a huge increase as compared to the previous slide. Therefore the vapor pressure is more as compared to the ideal solutions, now here in this system, their tendency of the molecules to escape from the solution is more than that of the pure liquids, now. This is because of the intermolecular forces of attraction of the

solution. They have a weaker forces as compared to that of the pure component. As a result since the forces are weak, the heat is absorbed and the volume increases. The examples are basically water- ethanol, ethanol - chloroform, etc. In this case, when we consider the change in heat that is changing increase in H , ΔH is absorbed, meaning it is positive and ΔV increases, that means ΔV is positive. In this case the ΔH is positive, meaning it's not equal to 0.

So here also ΔH is not equal to 0, so that means it obeys non ideal solutions.

Then we have type 3, IN type three. We have vapour pressure versus composition having a negative deviation. So in this case the X axis is the mole fraction again from left to right. If you go to see there is an increasing mole fraction of the liquid H and from right to left there is an increasing mole fraction of the liquid G. On the Y axis. vapor pressure of the component liquid component G and on the other side you have the vapor pressure of the liquid component H. So here also the dotted straight lines indicate the ideal solutions or the behavior of the ideal solutions. And if you see the vapor pressure of the solution is less than that

of the ideal solutions, which indicates a negative deviation.

So in this case the tendency of the molecules to escape from the solution is less than that of pure liquids. Here, in this case, the intermolecular forces of attraction of the solution are stronger then compared to those of the pure components. As a result, the tendency of the molecules to escape from the solution is less.

Therefore the vapor pressure is also less and you have a negative deviation. The change in heat or the change in enthalpy of mixing ΔH is negative and there is ΔV that is contraction in volume.

So ΔV of mixing is also negative, so the examples are water - nitric acid, and Water - sulfuric acid.

Hence, we can conclude that Raoult's law states that .

the vapor pressure of the liquid component is equal to the mole fraction of the liquid component into the vapor pressure of the pure liquid that is P . Hence it can be

concluded that for Raoult's law non-ideal solutions, that is

type one and Type 2 which show a positive deviation the vapour pressure of the liquid component is greater as compared to the

mole fraction into vapor pressure of the pure component, whereas

in Type 3 which shows a negative deviation, the vapour pressure of the liquid component is less than the mole fraction into the vapor

pressure of the liquid component.

Now the references contain whatever has been spoken to you.

Obtaining this books by Dr.R.L.Madan and G.D.Tuli Physical Chemistry,

Laxmeshwar,Sharma,Malushte Concepts of Physical Chemistry

by Chetana Publisher,Puri,Sharma,Pathania Principles of physical

chemistry ,R.L.Madan Chemistry for degree students.

Thank You