Name:_____

Break-out 14: Solutions

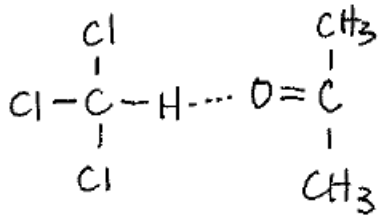
You have a mixture of chloroform ($CHCl_3$) and acetone (CH_3COCH_3). Plot the Pressure of the mixture as a function of the mole fraction of $CHCl_3$. In order to guide you, first address the following questions.

(a) Draw the structures of $CHCl_3$ and CH_3COCH_3.

(b) What intermolecular interactions occur between $CHCl_3$ and $CHCl_3$? What intermolecular interactions occur between CH_3COCH_3 and CH_3COCH_3?

$CHCl_3$···· $CHCl_3$: dipole-dipole
CH_3COCH_3···· CH_3COCH_3: dipole-dipole, dipole-induced dipole

(c) What interactions occur between and $CHCl_3$ and CH_3COCH_3? Do you think these interactions are stronger than the interactions between $CHCl_3$ - $CHCl_3$ and CH_3COCH_3 - CH_3COCH_3?



In addition to dipole-dipole interactions, now you can have H-bonding. These additional interactions should make the interactions between $CHCl_3$ and CH_3COCH_3 stronger than the self-self interactions. Note, normally H-bonds require that the H be bonded to an electronegative atom. C is not more electronegative than H, but the chlorides are extremely electron withdrawing (think of the inductive effect), and this helps to activate the C-H bond for H-bonding.

(d) Plot P_{mix}, P_{CHCl_3} and $P_{CH_3OCH_3}$ as a function of the mole fraction of $CHCl_3$. In what region of the graph does P_{CHCl_3} obey Raoult's Law? Henry's Law?

Because the intermolecular interactions in the mixture are stronger than in the individual solutions, molecules will be ***less likely*** to escape into the gas phase in the mixture.