IMMISCIBLE LIQUIDS AND STEAM DISTILLATION

1. a) (i) The total vapour pressure is the sum of the individual vapour pressures - 12.45 kPa.

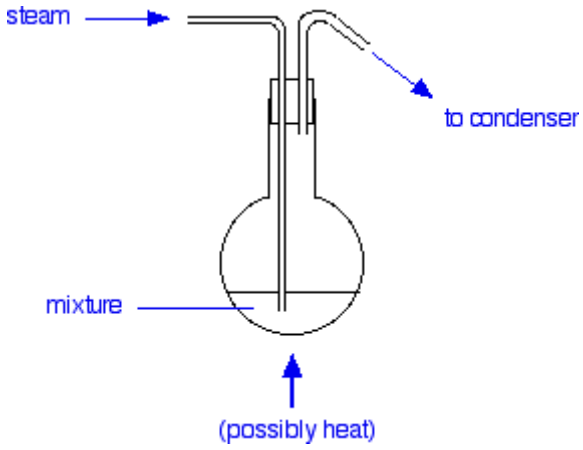
(ii) It would make no difference - the total vapour pressure will still be 12.45 kPa. The total vapour pressure is independent of the proportions as long as long as there is some of each liquid on the surface.

b) A liquid boils when its vapour pressure becomes equal to the atmospheric pressure. At 99°C, the total vapour pressure of the liquid mixture is 100.1 kPa, which is slightly less than the atmospheric pressure. That means that it is close to, but below its boiling point.

Pure water must have a vapour pressure of 101.325 kPa at 100°C, because that is its normal boiling point. The combined water and ethyl benzoate vapour pressures must reach 101.325 kPa at a temperature less than 100°C, and so the mixture must boil somewhere between 99°C and 100°C.

2. a) A liquid boils when its vapour pressure becomes equal to the atmospheric pressure. Just like the example in the last question, the total vapour pressure of a combination of water and phenylamine must reach atmospheric pressure before the vapour pressures of the pure components could. That means that the boiling point of the mixture must be less than the boiling point of either pure component. That enables you to remove the phenylamine from a mixture without having to distil it at a higher temperature which might decompose it.

b) Either describe this or use the diagram from the Chemguide page (or a combination):



Passing hot steam through the mixture boils the liquid (if it doesn't boil it, you can heat the mixture gently). The vapour given off is a mixture of phenylamine vapour and steam. This is passed through a condenser and collected as a liquid. (You don't need to worry about what happens next - the question is only about steam distillation.)

(Don't be put off by all the background detail in the question. It is mainly irrelevant to what the question is asking. Always focus on what you are being asked!)