

Chemguide – questions

IMMISCIBLE LIQUIDS AND STEAM DISTILLATION

1. Ethyl benzoate is a liquid with a boiling point of 213°C. It is virtually insoluble in water.

a) The vapour pressures of water and ethyl benzoate at 50°C are:

ethyl benzoate	0.20 kPa
water	12.25 kPa

(i) What would be the total vapour pressure of an equimolar mixture of the two liquids at 50°C? (Assume the mixture is vigorously stirred or agitated in some other way.)

(ii) What would be the effect on the total vapour pressure if you increased the proportion of water so that there were 3 moles of water to 1 mole of ethyl benzoate?

b) The vapour pressures of water and ethyl benzoate at 99°C are:

ethyl benzoate	2.34 kPa
water	97.76 kPa

What can you say about the boiling point of the mixture at atmospheric pressure (101.325 kPa)? Explain your answer.

2. Phenylamine, $C_6H_5NH_2$, is almost insoluble in water and is prepared in the lab by reducing nitrobenzene, $C_6H_5NO_2$, with tin and concentrated hydrochloric acid. When the reduction is complete, sodium hydroxide solution is added to produce free phenylamine. This will be present as very small drops in an aqueous solution containing all sorts of tin compounds, plus excess sodium hydroxide, and unreacted tin. To remove the phenylamine from the solution, steam distillation is used.

a) Explain the theoretical basis for the steam distillation in terms of the vapour pressures of water and phenylamine. (You don't need to quote actual figures.)

b) Describe briefly how you would carry out the steam distillation.