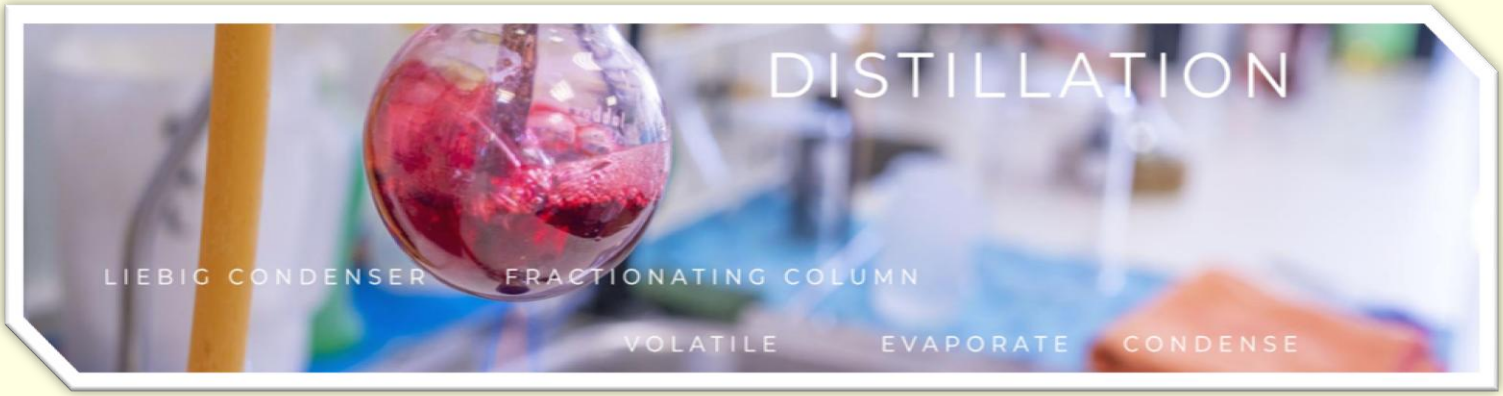
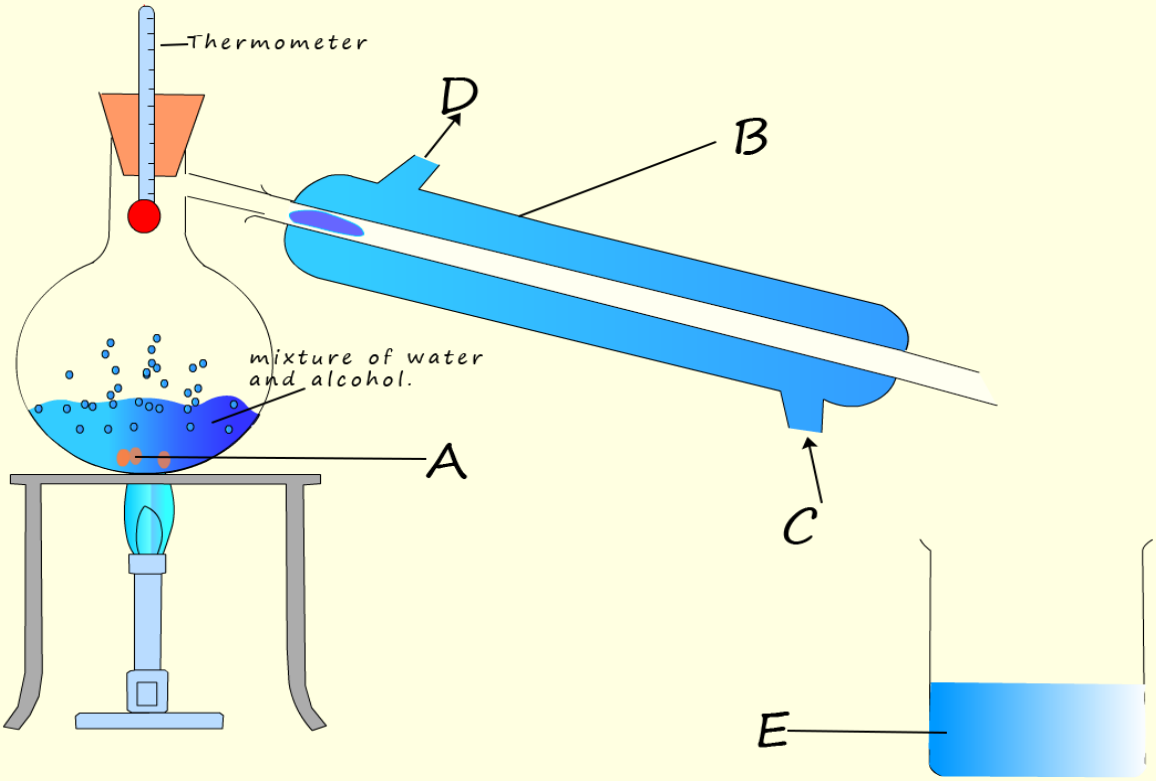


Answer all the questions below then check your answer when you're done.

1. The apparatus below can be used to distil a mixture of alcohol, boiling point 60°C and water, boiling point 100°C. The water and alcohol mixture were placed in the round-bottomed flask and heated gently. The temperature of the mixture was carefully monitored.

a. Name the part labelled A in the diagram below and explain what it does.



b. What enters at C and leaves at D in the diagram?

c. Name the piece of apparatus labelled B in the diagram. Explain how it works.

d. What is the liquid labelled E in the diagram?

e. What temperature will the thermometer read when the alcohol is evaporating?

f. How can you tell when all the alcohol has evaporated from the round-bottomed flask?

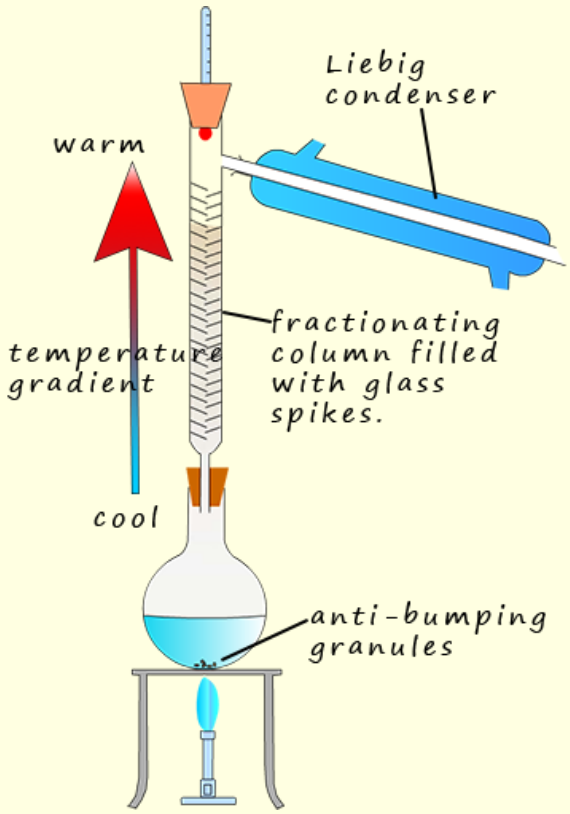
g. Explain in your own words how distillation is used to separate a mixture of alcohol and water as shown in the diagram.

h. Explain why the set-up above is not entirely suitable to separate out the mixture of 3 liquids and what should be added to improve the set-up.

2. A student needs to separate2 liquids, liquid A and B. Their boiling points are:

Liquid A has a boiling point of 75°C

Liquid B has a boiling point of 77°C



i. Explain why the simple distillation apparatus used in question 1 would not be suitable to separate these 2 liquids.

ii. The simple distillation apparatus from question1 can be improved by the addition of a fractionating column, shown opposite. Explain how this would be enable you to separate the two liquids A and B.

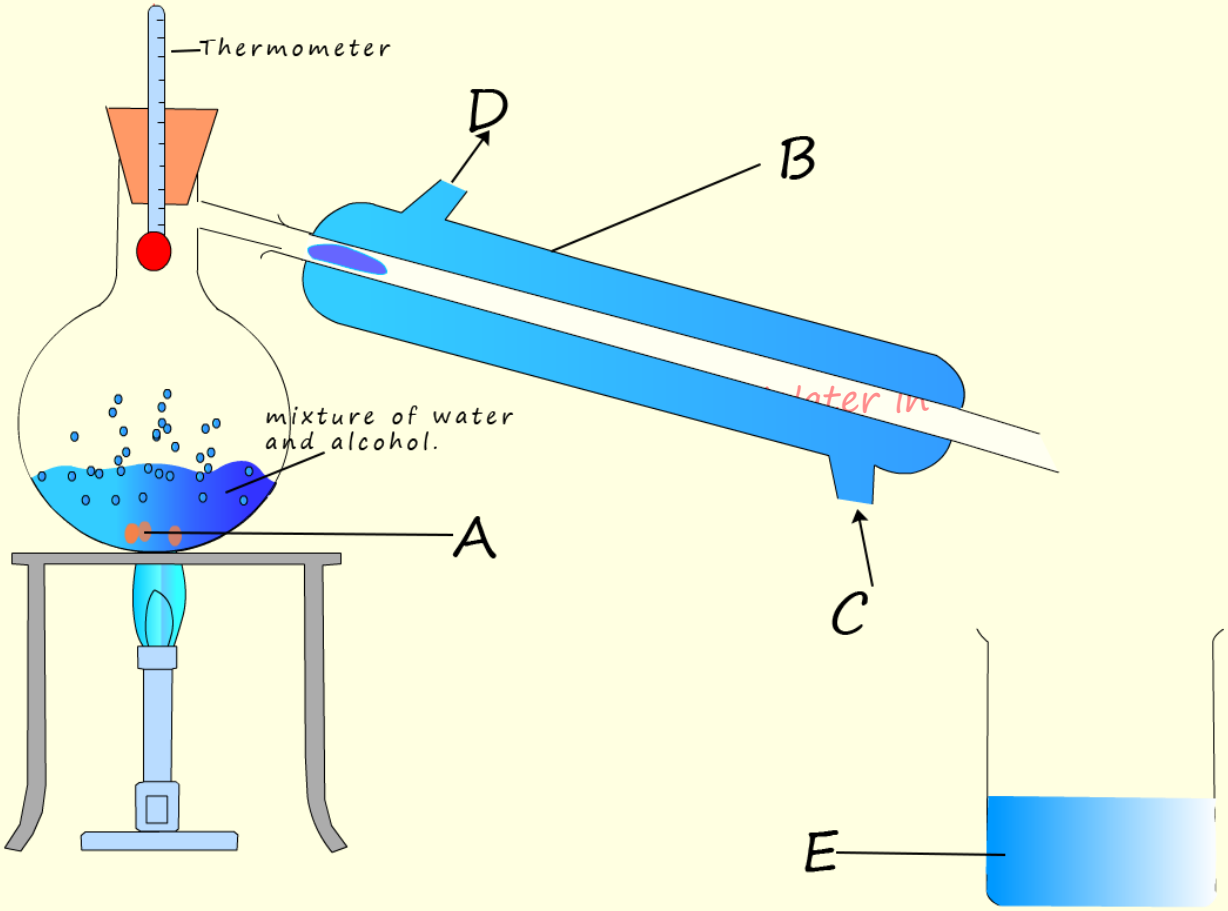
III. Why are anti-bumping granules needed to carry out a distillation experiment?

Answers

1. The apparatus below can be used to distil a mixture of alcohol, boiling point 60°C and water, boiling point 100°C. The water and alcohol mixture were placed in the round-bottomed flask and heated gently. The temperature of the mixture was carefully monitored.

a. Name the part labelled A in the diagram and explain what it does.

Anti-bumping granules help the liquids boil smoothly.



b. What enters at C and leaves at D in the diagram? Cold water enters at C and hot water will leave at D

c. Name the piece of apparatus labelled B in the diagram. Explain how it works.

Liebig condenser. The inner tube of the Liebig condenser is cooled by tap water. Once any vapour enters this inner tube it condenses and forms a liquid which runs down the inner tube and is collected.

d. What is the liquid labelled E in the diagram? The distillate. The liquid with the lowest boiling point will evaporate first, in this case the alcohol will evaporate and form alcohol vapours which enter the Liebig condenser where they are cooled and condensed to form liquid alcohol again.

e. What temperature will the thermometer read when the alcohol is evaporating? The boiling point of the alcohol, 60°C.

f. How can you tell when all the alcohol has evaporated from the round-bottomed flask? The thermometer reading will start to rise above 60°C.

g. Explain in your own words how distillation is used to separate a mixture of alcohol and water as shown in the diagram.

The liquid with the lowest boiling point will evaporate first from the round-bottomed flask. The hot vapours rise and enter the still head and then the Liebig condenser. Here the vapours cool and condense to form a liquid. Once the thermometer reading starts to rise above the boiling point of the evaporating liquid you know then that it has mostly all evaporated and the next liquid in the mixture is starting to evaporate.

h. Explain why the set-up above is not entirely suitable to separate out the mixture of 3 liquids and what should be added to improve the set-up.

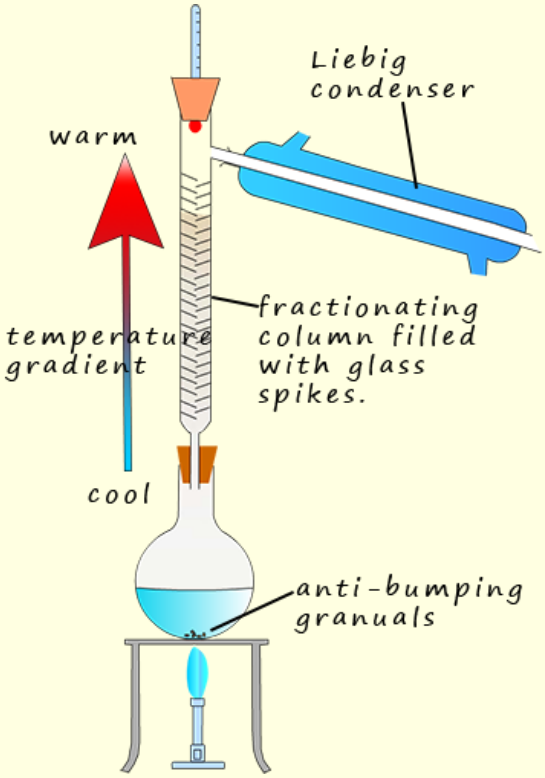
The liquids which are collected in the beaker will likely not have been separated fully due to the lack of a fractionating column. The fractionating column is

necessary to ensure complete separation of the mixture of liquids. The students has set-up the experiment for simple distillation which is really suitable.

2. A student needs to separate2 liquids, liquid A and B. Their boiling points are:

Liquid A has a boiling point of 75°C

Liquid B has a boiling point of 77°C



i. Explain why the simple distillation apparatus used in question 1 would not be suitable to separate these 2 liquids.

Their boiling are too close together, both liquids would evaporate together and would not be separated out.

ii. The simple distillation apparatus from question1 can be improved by the addition of a fractionating column, shown opposite. Explain how this would be able to separate the two liquids A and B.

The tall thin fractionating column has a temperature gradient in it, it is cooler at the bottom and hotter at the top. If both liquids A and B evaporate together then the liquid with the highest boiling point will condense part way up the fractionating column and drip back into the flask. The liquid with the lowest boiling will condense higher up the fractionating column. If enough is applied at the bottom the liquid with the lowest boiling point can be pushed all the way up the column and into the Liebig condenser where it will condense.

III. Why are anti-bumping needed to carry out a distillation experiment? To ensure the liquids boil and evaporate smoothly. They provide a surface on which boiling can occur.