

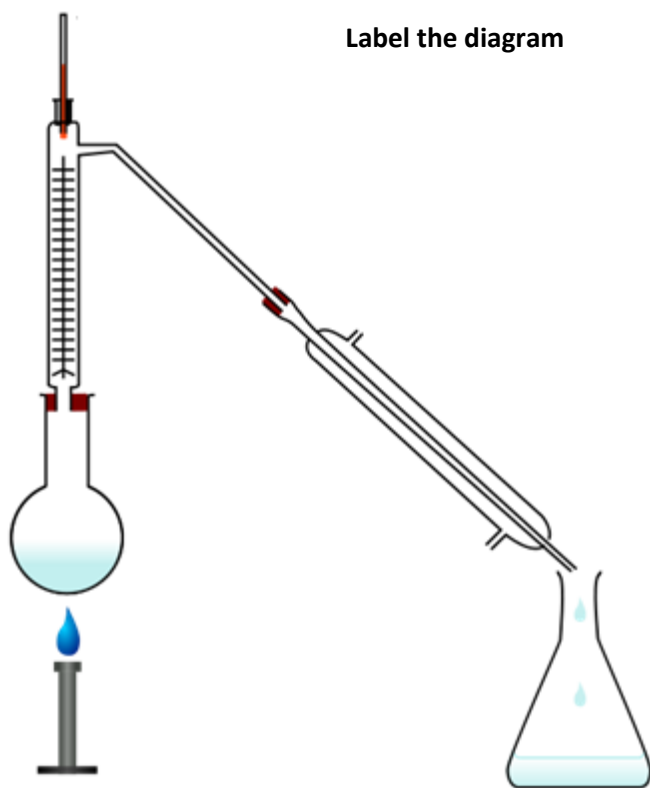
Fractional Distillation Worksheet

What is fractional distillation?

Fractional distillation is the process used to separate two _____ liquids based upon differences in boiling point.

Example: Ethanol has a boiling point of _____. Water has a boiling point of _____. Both water and ethanol are infinitely miscible in one another. This means the resulting mixture looks like a _____ liquid no matter how much ethanol or water is added. Water and ethanol can be separated by the process of fractional distillation.*

How does fractional distillation work?



When a mixture of soluble liquids is heated all liquids are evaporated. The liquid with the _____ boiling point however, forms the greatest percentage of vapour.

A _____ column is needed to further separate the mixture.

As the vapour moves up the fractionating column it becomes progressively _____ with the component that has the lowest boiling point.

This is due to the vapour mixture continually condensing and _____ as it moves up the column.

A thermometer is used to measure temperature of the gaseous fractions before they _____

The liquid with the lowest boiling point will be the first 'fraction' or portion of the _____

** In reality an azeotropic mixture is produced when the mixture reaches 95% ethanol and 5% water. This prevents further purification by fractional distillation. An _____ is a mixture of two miscible liquids that has a constant boiling point and composition.*

Questions

- Fractional distillation is used to separate
 - what type of mixtures?
 - on the basis of what physical property?
- What additional piece of glassware is needed for fractional distillation compared to distillation?
- What is the maximum purity of ethanol that obtained by the fractional distillation of ethanol and water?
- Why can't 100% ethanol be obtained by the fractional distillation of a mixture of ethanol and water?
- Research:** How is fractional distillation used in the petroleum industry?

Fractional Distillation Worksheet - ANSWERS

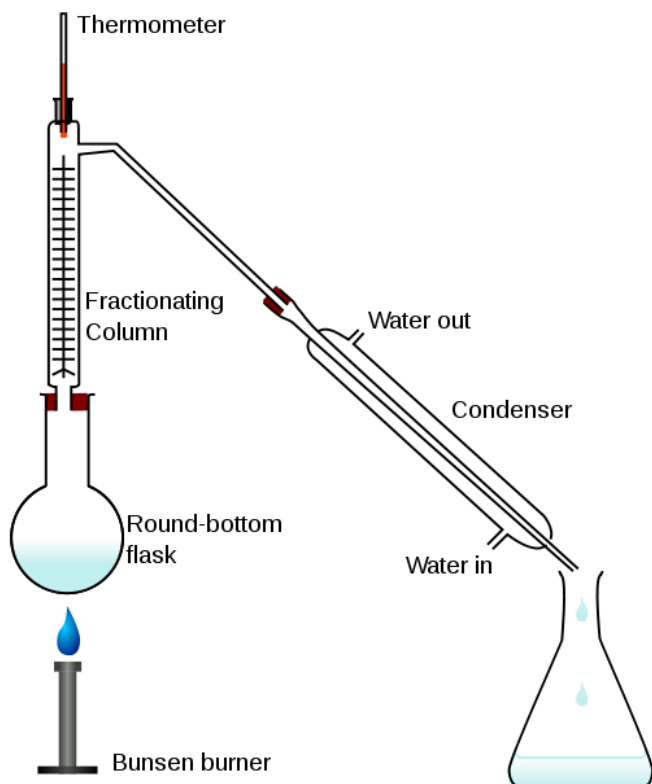
What is fractional distillation?

Fractional distillation is the process used to separate two **miscible** liquids based upon differences in boiling point.

Example: Ethanol has a boiling point of 172 °F or 78 °C. Water has a boiling point of 212 °F or 100 °C.

Both water and ethanol are infinitely miscible in one another. This means the resulting mixture looks like a **single** liquid no matter how much ethanol or water is added. Water and ethanol can be separated by the process of fractional distillation.*

How does fractional distillation work?



When a mixture of soluble liquids is heated all liquids are evaporated. The liquid with the **lowest** boiling point however, forms the greatest percentage of vapour.

A **fractionating** column is needed to further separate the mixture.

As the vapour moves up the fractionating column it becomes progressively **richer** with the component that has the lowest boiling point.

This is due to the vapour mixture continually condensing and **evaporating** as it moves up the column.

A thermometer is used to measure temperature of the gaseous fractions before they **condense**.

The liquid with the lowest boiling point will be the first 'fraction' or portion of the **distillate**.

* In reality an azeotropic mixture is produced when the mixture reaches 95% ethanol and 5% water. This prevents further purification by fractional distillation. An **azeotrope** is a mixture of two miscible liquids that has a constant boiling point and composition.

Questions

- Fractional distillation is used to separate
 - what type of mixtures? *Miscible liquids*
 - on the basis of what physical property? *Differences in boiling points*
- What additional piece of glassware is needed for fractional distillation compared to distillation?
A fractionating column
- What is the maximum purity of ethanol that obtained by the fractional distillation of ethanol and water? *95%*
- Why can't 100% ethanol be obtained by the fractional distillation of a mixture of ethanol and water?
Water and ethanol form an azeotropic mixture at 95% ethanol. This mixture has a constant boiling point and cannot be further separated.
- Research:** How is fractional distillation used in the petroleum industry? *Own student research*