

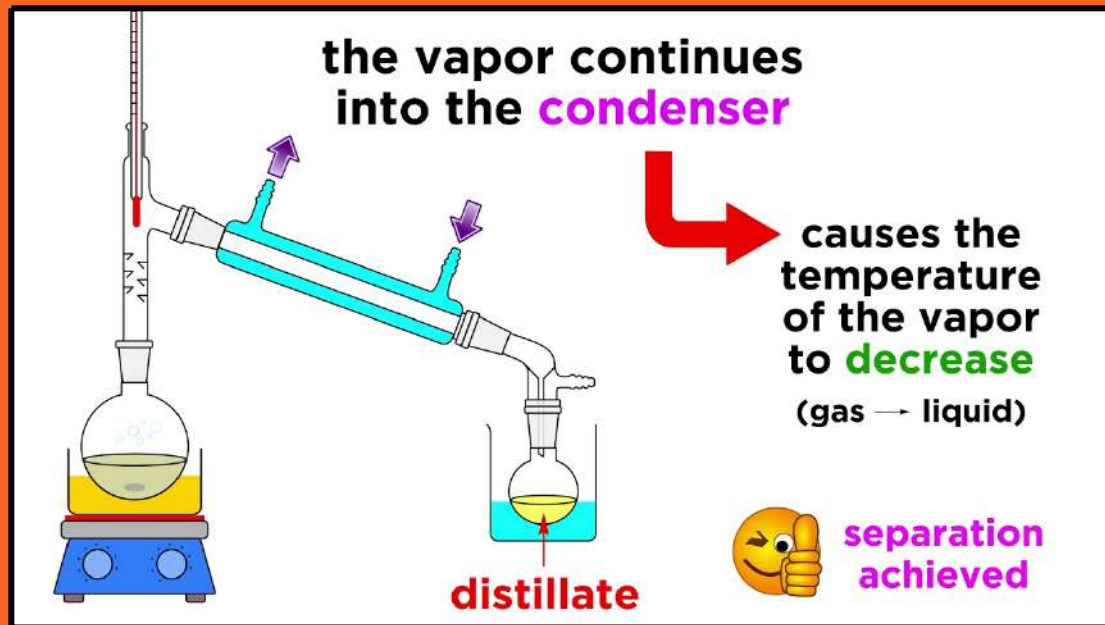
Introduction to Organic Distillation Techniques

Introduction to Distillation

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Boiling Point

Distillation Theory
(Simple vs. Fractional)



As you watch the video on each slide, answer the questions on the other! When finished, please submit your slides to google classroom. Click on your first video above to see concepts you will learn about!

Video credits to Dr. Laura Starkey and MERLOT of the California State University System

Types of Distillation

1. What is the purpose of distillation?

Answer

1. List the 2 types of distillation and give an example of each

Answer

Distillation: Purify a Liquid

to separate a liquid
from a nonvolatile
contaminant



Simple
Distillation

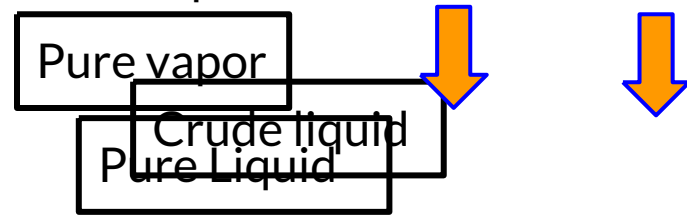
to separate a
mixture of liquids



Fractional
Distillation

Theory of Distillation

Organize the THREE basic steps by dragging the boxes and arrows where they need to be after watching the video clip



Theory of Distillation

A liquid is boiled and the vapors are condensed into a new container.

crude liquid
↓
pure vapor
↓
pure liquid

The diagram shows a distillation setup. A round-bottom flask is heated by a Bunsen burner. The flask is connected to a condenser, which is angled downwards. The condenser is connected to a collection flask. The process is labeled with the following steps: crude liquid, pure vapor, and pure liquid.

Simple Distillation

1. What liquid is used to cool the condenser?

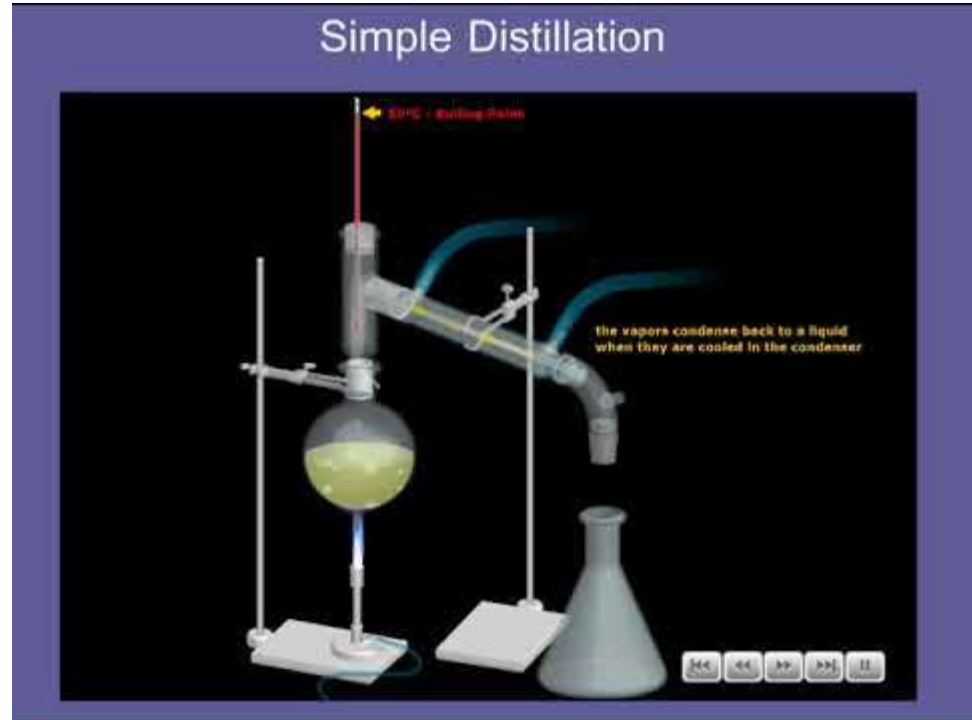
Answer

1. How do we know if the vapor is pure?

Answer

1. What are the collected droplets called?

Answer



Boiling Point

1. Is “boiling point” a singular value?

Answer

1. What is a good indication of a pure liquid?

Answer

Boiling Point

- a physical property of a liquid
 - used for characterization and indicates purity
 - reported in the lab as a **boiling point range**
-

Vapor Pressure and Volatility

Drag the properties to the proper column that describe each term

Volatile Liquid	Non-Volatile Liquid

EX Slow to evaporate g point
Low vapor pressure g point

Vapor Pressure and Volatility

- Liquids are in equilibrium with vapors
- Vapor molecules exert a vapor pressure

Volatile liquid

- Low boiling point
- High vapor pressure
- e.g., diethyl ether



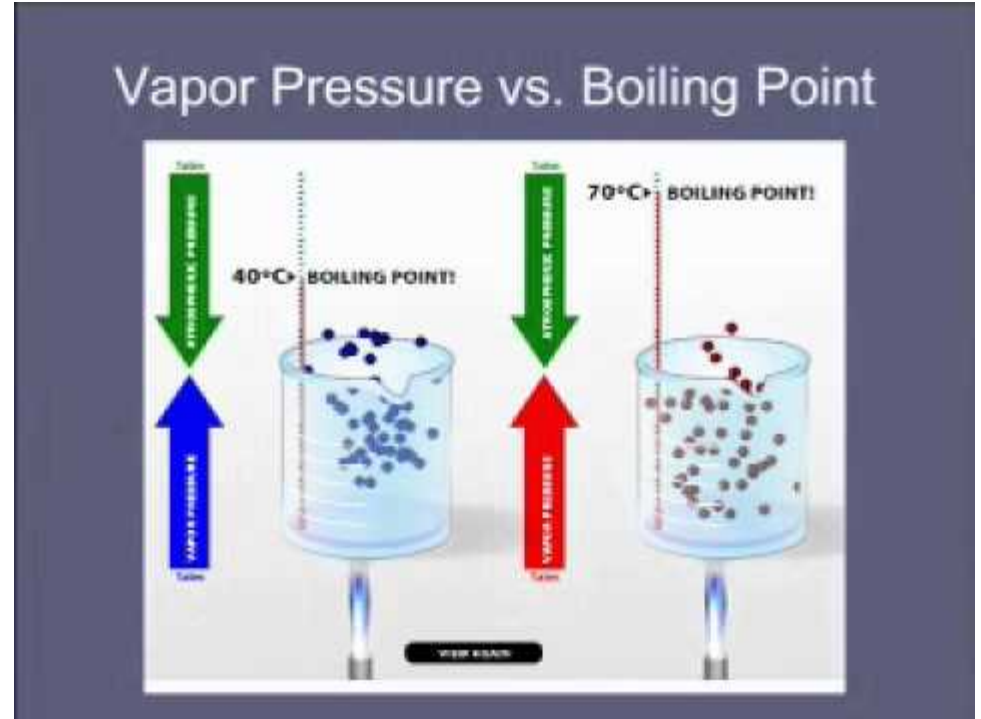
High vapor pressure
more volatile
lower boiling point

Low vapor pressure
less volatile
higher boiling point

Vapor Pressure Vs. Boiling Point

Explain why volatile substances boil at low temperatures - what is going on with the different pressures?

Answer



The Purpose of Boiling Chips

1. What is a superheated liquid?

Answer

1. What are 2 ways to prevent a superheated liquid

a. Answer

b. Answer

The Purpose of Boiling Chips

- Prevents superheated solutions:
DANGER!

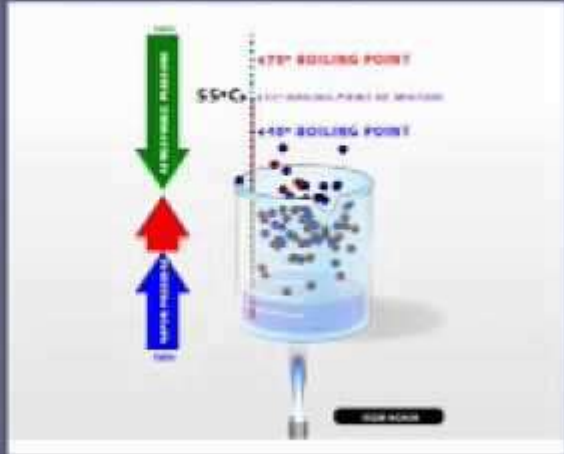
Mixtures of Liquids

Fill in the blanks:

1. A mixture of liquids will have a mixture of above the surface.
2. Dalton's law states that the total pressure above the liquid will be the of both of the partial pressures.
3. Because both liquids contribute to the total vapor pressure, the boiling temperature will be the boiling points of both liquids.
4. Even with a 1:1 ratio, the vapor pressure will have a greater concentration of the gas with the boiling point.
5. If there is a large amount of A in the liquid mixture, there will be a amount of A in the vapor mixture.

Mixtures of Liquids

Dalton's Law

$$P_{\text{total}} = P_A + P_B$$


The diagram shows a beaker of liquid being heated by a Bunsen burner. A thermometer is placed in the liquid, showing a temperature of 55°C. A green arrow labeled 'TOTAL VAPOR PRESSURE' points downwards, and a red arrow labeled 'VAPOR PRESSURE' points upwards. The boiling point is indicated as 47°C. The text 'DALTON'S LAW' is written above the diagram.

Distilling a Mixture of Two Liquids

What do you predict the mixture of the vapors to be like?

Answer

Distilling a Mixture of Two Liquids

Consider a 1:1 mixture of two liquids, A and B.

A	B
bp 40 °C	bp 70 °C
higher vapor pressure	lower vapor pressure
more volatile	less volatile

Simple Distillation: Changing Vapor Composition

Distillation Process	Temperature	Composition of Vapors
Beginning		
Middle		
End		

Simple Distillation:
Changing Vapor Composition

- initial distillate: mostly A
- vapor composition changes continuously
- later distillate has more B

Lowest

Highest

Mostly A

Mostly B

Middle

Slightly more B

Drag and drop the terms into the chart after watching the clip!

Fractional Distillation: Constant Vapor Composition

1. List 2 Things that can be “packed” into a fractional distillation column:
 - a. [Answer](#)
 - b. [Answer](#)
2. How is fractional distillation different than simple distillation?

[Answer](#)

Fractional Distillation: Constant Vapor Composition

- initial distillate: pure A
- vapor composition remains constant

Greasing Ground-Glass Joints

1. What are ground-glass joints?
 - a. Answer
2. How can you tell if a ground-glass joint is greased?
 - a. Answer
3. What are 2 solvents you could use to clean off the excess grease?
 - a. Answer
 - b. Answer

Video: Greasing Ground-Glass Joints



Heat Sources

Fill out the table:

Heat Source	Pro	Con



Setting up a Simple Distillation Apparatus

Name the things the arrows are pointing to.

Answer

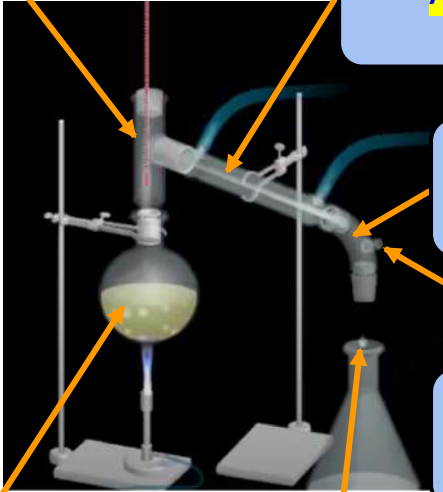
Answer

Answer

Answer

Answer

Answer



Video: Setting up a Distillation



Fractional Distillation Apparatus

1. What “changes” do need to make to your “simple” set-up for fractional distillation?

a. Answer

b. Answer

2. What is “reflux”?

a. Answer

Video: Fractional Distillation Apparatus



Running a Distillation

Drag/drop the steps from the video in order.

1

Record the temperature

Set up your fractional distillation

2

Double check fittings and clamps

Monitor the appearance of vapor

Monitor thermometer temperature

3

Wrap the column in a “jacket”

Gently turn on the water
(enters bottom, exits top)

4

Begin heating your solution

Video: Running a Distillation

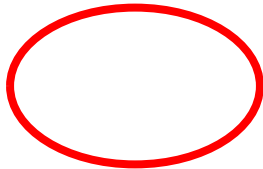


Dismantling a Distillation

True or False

You should wait until the round bottom flask has completely cooled before you remove the heating mantel.

(Drag the oval around the correct answer)



Video: Dismantling a Distillation



Common Mistakes

Provide the solutions for the common mistakes to avoid from the video clip:

1. Condenser isn't filling with water
 - a. [Answer](#)
2. Glass fittings not tight
 - a. [Answer](#)
3. Thermometer not registering correctly
 - a. [Answer](#)
4. Experiencing reflux
 - a. [Answer](#)
5. Heating mantle plugged directly into the outlet
 - a. [Answer](#)

Video: Common Mistakes



Congratulations you are almost done with chemistry for today!

Click the flask below to complete your exit ticket! Don't forget to "turn in" your edited slides!

