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Distillation Apparatus with Graham Condenser & Ground Glass Joints #4007-SET

Warning:

- **Not a toy; use only in a laboratory or educational setting.**
- **When working with acids, wear eye and skin protection. An electric heating block can be used to prevent flammable compounds from catching fire.**
- **California Proposition 65 Warning: This product can expose you to chemicals including nickel and lead, which are known to the State of California to cause cancer, birth defects, or other reproductive harm. For more information go to www.P65Warnings.ca.gov.**

Introduction

The principle of distillation is fairly simple, although the practice may sometimes involve a great deal of work. No two liquids have exactly the same boiling point. Therefore, it is possible to separate any mixture of two liquids by raising the temperature of the mixture to a point where one of the liquids will become vapor but the other will remain liquid.

By condensing the resulting vapor, it is possible to end up with two containers, each containing a relatively pure liquid. While this is true in theory, in practice the case is somewhat different. As long as there is a fairly high concentration of the liquid having the lower boiling point in the initial mixture, the mixture will not become any hotter than that temperature. However, as more of the volatile liquid boils away, and the concentration drops, a point will be reached where there is not enough of the volatile liquid to carry away the heat, and the solution will quickly reach the boiling of the other liquid in the mixture. This forces us to make a choice between halting the distillation process before the two liquids are completely separated, or carrying on to the point where some of the higher boiling point liquid will be evaporated and condensed, thereby contaminating the distillate.

In practice, there are three ways around this problem. One is to provide a means of adding more of the mixture to the boiling flask, and so keeping enough of the lower boiling point liquid in the solution. Another is to closely monitor the temperature of the vapor at the top of the distillation column, and turn the heat down whenever the temperature begins to climb. A third way is to accept that there will be some contamination of the distillate, and use some other means of separation for a final purification.

These methods work well when there is a sufficient difference in the boiling points of the two liquids. However, when the difference is slight, or when there are several components present that have

similar boiling points, other methods must be used. One of these methods is fractional distillation, which relies not on the boiling point, but upon the relative density of the resulting vapors. When several components in a mixture have differing boiling points, the one with the lowest boiling point will have a lighter vapor than the second, which will have a lighter vapor than the third, and so on.

If the vapors are collected in a tall vertical column, therefore, the first component will rise to the top of the column, with each succeeding component below it. It is then possible to draw the various fractions off of the column by means of valves at appropriate levels. This is the method sometimes used in oil refineries.

In laboratory use, such columns are used when extreme purity is required, or when the boiling points of the components are close. A more recent method uses a similar column, but performs the actual separation by means of catalysts.

Useful Note:

- Graham Condensers need to be used vertically for optimal efficiency during experiment, if not, the liquid may clog in the coils or not flow correctly.

Helpful, But Not Included:

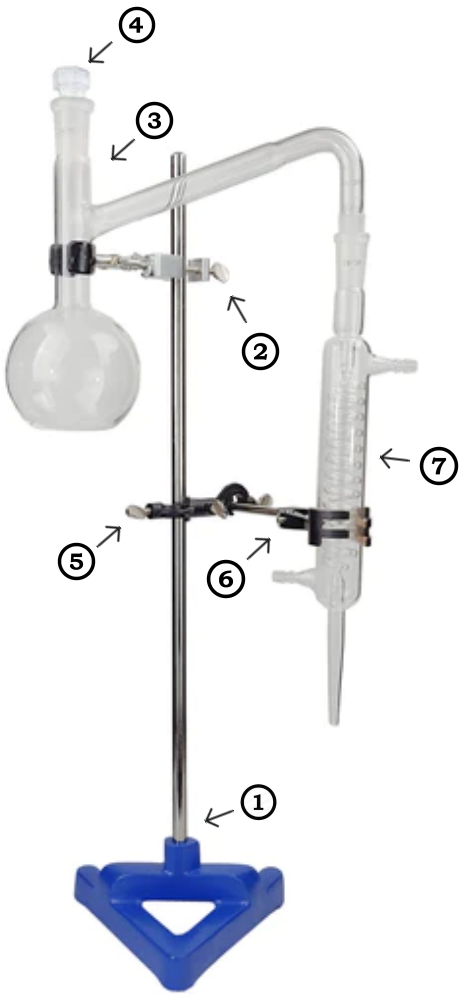
- Latex Tubing- to connect to the Graham Condenser to allow liquid to enter and exit
- Thermometer- useful for measuring the temperature of the vapor. This will be placed at the top of the distilling flask. You will also need a 1-hole rubber stopper to insert at the top of the distilling flask to be able to secure the thermometer in the apparatus.
- Bunsen Burner- used to heat up the liquids at the bottom of the distilling flask
- Burner Tripod or Lab Jack - you will need a stand to put your burner on to be able to place it close enough to your flask to boil liquid.
- Watch glass or flask- for collecting distillate that comes back out of the Graham Condenser.

GSC Suggested Parts:

·Butane Burner #1394 ·Lab Jack #LBJK150 ·Flask #EF250
·Burner Tripod #4-BT54 ·Watch Glass #000-109 ·Rubber Stopper #RS-4-1

What's Included:

1. Support Stand
2. Buret Clamp
3. Distilling Flask
4. Glass stopper
5. Boss Head Clamp Holder
6. Extension Clamp
7. Graham Condenser



Set Up

1. Start with setting up your support stand. Screw the rod into the base.
2. Attach the buret clamp towards the top of the rod.
3. Attach the distilling flask to the buret clamp
4. Place the glass stopper into the top of the distilling flask
5. Attach the boss head clamp holder to the rod below the distilling flask
6. Attach the extension clamp to the boss head clamp holder
7. Place the graham condenser through the extension clamp, making sure it is lined up with the elbow of the distilling flask, and tighten to secure in place.
8. From here, you can set up your heat source and stand under the distilling flask and place either a watch glass or flask below the bottom of the graham condenser to gather the distillate.
9. If you are using latex tubing, attach them on each of the graham condensers outlet and inlet arms.
10. If you are using a thermometer, you can remove the glass stopper from the top of the distilling flask and replace it with a 1-hole rubber stopper and then put your thermometer through that into place.

Simple Distillation Experiment

1. For this experiment, we will be using isopropyl alcohol and tap water. Put both the alcohol and water into the distillation flask to create a mixture. We will use cold water for the cooling liquid in the graham condenser
2. As you heat up the mixture, the alcohol will evaporate before the water will since alcohol evaporates at around 83°C and water at about 100°C. While you are waiting for the distillate, be sure that you are monitoring the temperature of the mixture. If the temperature rises too much and reaches the point of evaporation for the water, you will not get a pure alcohol distillate in the end. It must stay within range for it to work well.
3. Begin to turn on your cooling system, in this case cold tap water, to flow through the outer portion of the graham condenser.
4. After some time, you will start to see the condensation from the alcohol vapor appear and start to drip down the graham condenser. Eventually, there will be enough accumulated to start dripping down into your watch glass.
5. A way to test whether your experiment was successful is to use a lighter and put it near the watch glass. If a flame appears, then it is pure alcohol and your experiment was successful. If it does not light, there is likely too much water still in the mixture and it will need to go through the distilling process again.

WARNING: Always use protective gear when dealing with chemicals and open flame. Use caution when performing experiments.