

[MUSIC PLAYING]

**PROFESSOR:** Patience is a virtue. We all learned that when we were young. It'll come into play during our filtrations in this video. The process of filtration is used to separate your solid product from solvent or to remove impurities from your solution. This video will discuss three types of filtration, microscale filtration via Pasteur pipet, gravity filtration, and finally, vacuum filtration.

First, let's address microscale filtration. We'll be using the Pasteur pipet to carry out this type of filtration. I bet you never thought you could have this much fun on such a small scale.

Here's how to prepare your filter pipet. Here's a piece of cotton. Break off a small bit. Roll this into a small ball. The ball should be about the size of the top opening of the pipet.

Place the cotton ball there. You can use either copper wire or another pipet to stuff down the cotton. With a few jabs, it should be nicely wedged in there. You want to firmly pack it down so it enjoys a snug fit between the wide portion and the narrow portion of the pipet.

But let's add something extra. As you can see, here is the cotton, but sitting on top of it, we've placed celite. What is it, you may ask? Celite is a very fine powder used to filter very small particles. We'll be using it in this filtration.

Now for the setup. Here, we have the mixture to be filtered. And here, we have our filter pipet, which is securely clamped to a stand, and we've placed a collection vial underneath it.

Now it's time for filtration. Draw up some of the mixture with another pipet. Transfer the mixture to your filter pipet. Allow it to do its filtering job.

[MUSIC PLAYING]

Look down at the tip of the filter pipet. Can you see? Squint, if you must. The filtered liquid should be draining out into your collection vial.

[MUSIC PLAYING]

All right, all right. I'll spare you the squinting. Look. Our once black mixture is now clear when filtered.

But what's that I hear? You're a bulb fiend? Or what's worse, you just have no patience?

If you insist on using the bulb to expedite your filtration, then there are some rules for its usage. When using the bulb, don't push so eagerly that impurities get pushed through the cotton or that the cotton is pushed out itself. And once you begin, never release the bulb since air, impurities, or even the cotton could be sucked back up.

Let's get back on track and take care of rinsing. As you can see here, there's residual mixture left in the flask. Rinse the flask with solvent, allowing it to run down the sides and collect any residual mixture. Draw up these washings into the pipet and transfer them, adding the washings to the filter pipet, allowing them to be filtered themselves. You need to rinse the flask and add its washings a total of three times.

When the filtration's all done, we'll have the filtered product. Here it is, the beauty. Free of impurities.

But let's take one last look at our filter pipet. Here it is after the filtration. As you can see, impurities have collected on top of the celite. So that was microscale. Let's go macroscale with gravity filtration.

First, let's explore chemistry origami while fluting our filter paper. Here's our goal. You should always fold when fluting. Making a harsh crease might cause filter paper to tear eventually.

Let's get started. First, you want to fold it in half. Open it up and fold it in half once again, this time in the opposite direction. You want to pinch the bottom and push in, like so. Notice how it now forms a sort of x. Open it slightly and do the pinch and push move once again, this time in the opposite direction.

As you can see, you're already halfway there. You should have four main sections. Take one section and separate it from the rest. Push in the crease, and fold back the little triangles that form. You want to do the same thing for the next three sections.

Essentially, you're forming two little triangles from one big one, like a mother giving birth to twins. Isn't that great? You're halfway to a fully fluted filter paper. Try saying that three times fast.

By the end of this, all the folds should be alternating. This creates the fluted majesty. Don't worry. You'll get the hang of it. Aaa!

You may be asking, why should we even bother to flute? Well, it increases the surface area of contact between the mixture and the filter paper, therefore, a more efficient filtration.

Now for the setup. Here, we have our mixture to be filtered, and here, we have our collection flask. Into the flask, place your funnel. It should be appropriately sized.

And into the funnel, place the fluted filter paper. Don't you feel proud? Now that we're all set up, it's time for filtration.

Pour the mixture onto the filter paper. Be sure not to pour too much that it overflows.

[MUSIC PLAYING]

As the filtration progresses, add more of the mixture.

But remember, there's always rinsing. Here, we can see the residual mixture in the flask. Using a pipet, make sure to rinse your flask with solvent, allowing it to run down the sides and pick up the residual mixture. Then add these washings to the filter paper.

Ah, but don't forget, you want to rinse the filter paper with solvent as well. Use a pipet. Like always, you want to rinse your flask and the filter paper three times each.

When you think gravity's done all that it can, it's time for collecting the product. If you were aiming for the solid product, take the filter paper out of the funnel and place it on another piece of filter paper or a watch glass, and allow the product to dry overnight. But what if you have three psets, a test tomorrow, a paper due the next day, and your mixture just doesn't seem to understand you're pressed for time? Well, then you have the option of vacuum filtration.

For vacuum filtration, you can use either the Buchner or the Hirsch funnel, depending on what you're filtering and how much there is to filter. Really, there's not much difference between the two besides shape and size. Now for the setup.

Here, we have our filter flask. Notice its characteristic sidearm. Make sure the flask is clamped firmly to a stand. When it's all put together, the filter and funnel will make a top-heavy structure, making it prone to fall. So a clamp is your best bet.

And here is our Buchner funnel. If it doesn't already have a rubber adapter, add one. Securely fit the funnel and adapter into the top part of the flask.

But what's that, you say? The fit between the funnel and the flask isn't snug enough? Well, there's an alternative.

Another type of rubber adapter. Notice its shape and size. And look in the middle there. There's a raised area.

This raised area fits into the mouth of the flask, as seen here. Push down so that the flat side is on the top and there's a nice snug fit at the top of the mouth. Then take your Buchner funnel and securely fit it into the adapter. Regardless of the type of adaptor you use, be sure to have a snug fit before you proceed with your filtration.

The piece of filter paper should be large enough to cover the funnel space but not fold up onto the sides. Now add the water trap to the setup. Make sure it's firmly clamped to the stand.

It consists of a filter flask. Also, notice its sidearm. A rubber stopper. This can also be some sort of glass stopper. And tubing.

Attach one end of vacuum tubing to the tube on the water trap and the other end to the side arm of the filter flask. Then attach the side arm of the water trap to the water aspirator via more vacuum tubing. So at this point, you might be wondering, what do the water aspirator and water trap do anyway?

When the water aspirator is turned on, out comes a rush of water. This rush of water causes suction in the tubing. This then suctions out the air from the system. Consequently, a vacuum is created in both the filter flask and the water trap. Now we can filter.

When we finally finish, we'll have to turn off the aspirator. This may cause water to rush back into our system, and this could be potentially bad. But look! Our water trap prevents the water from entering our filter flask. And so luckily, our filtrate is saved from any water contamination. Yay! This is why we love, and more importantly use, the water trap.

But what if you're using the house vacuum line instead of the water aspirator? Well, the filter flask sidearm should then be directly attached to the house vacuum nozzle via tubing. Don't worry about any intermediaries like the water trap.

So now it's time for filtration. Turn on the water aspirator at full force. The vacuum should suck down the filter paper.

Wet the filter paper with solvent so that it sticks to the base of the funnel. You don't want it floating up later. Here's our mixture to be filtered. Take the mixture and pour it into the funnel, but make sure that you pour the mixture into the middle of the funnel.

[MUSIC PLAYING]

Don't pour it in all at once. Pour in more of the mixture as the filtration progresses. We can't forget that rinsing, though. As usual, there's residual mixture left. Rinse the flask with solvent, allowing it to run down the sides and pick up any residual mixture.

And add these washings to the filter flask. And remember to rinse the filter paper with solvent as well. Round and round goes the pipet.

You should rinse your flask and the filter paper in the funnel three times each. Allow the filtration to come to an end. Once you think it has, then it's time for turning off the aspirator.

[WARNING BEEPS]

If you did not attach a water trap, take tubing off before turning off the aspirator, otherwise, water might rush into your flask. So how about collecting the product? If you were aiming for the solid product, use a spatula or some sort of tool to release the filter paper from the funnel. Set it down on another piece of filter paper or a watch glass, and allow the product to dry overnight.

So now, you're finally all filtered. Now that you've got the skills, go out and purify the world. Remember, this video is intended to help you prepare for lab by providing a demonstration of the proper experimental technique. It is not intended as a replacement for reading your lab manual or the supplementary material.

In order to become a great experimentalist, it is important that you understand both theory and technique. Now it's your turn. Good luck.

[MUSIC PLAYING]