

Fabric face mask

This mask is based on the great pattern at ragmask.com. My version has some tweaks that make the mask more durable by eliminating most of the raw fabric edges. The result is something that can withstand many trips through the washing machine without fraying, but which takes a bit more time to make. Like the original pattern, it is very simple to cut out and sew, comfortable to wear, fits well to your face, stays mostly away from your mouth, and (if you bend the wire properly) doesn't fog up your glasses. **I have also developed and tested children's sizes (more info below).**

Get started: Download the free pattern at ragmask.com.

- Print 2 copies of the first page and check the scale using the ruler provided on that page.
- From one of the copies, cut out the semicircular template (see step 7 of the ragmask instructions for a picture).
- From the other copy, cut out the strap guide (see "Pro tip: Fast straps" in the ragmask instructions for a picture).

Ragmask.com also has a picture of what the finished mask looks like.

Choose your fabric.

There is ongoing research about the best fabrics to use. I have read a few scientific articles on this and the most useful one so far is Lustig et al. 2020 (<https://doi.org/10.1021/acsnano.0c03972>). They tested many combinations of fabrics and they also used a more realistic virus/droplet test than some other papers. Here are some of the most important points from that article, other sources, and my own experience:

- Make sure you can breathe through two layers of the fabric. Fold the fabric so you have two layers, hold it over your nose and mouth, and breathe. If it's a bit of work but you feel like you can keep it up for an hour, the fabric is probably fine. If it's too hard to breathe through, the mask will be ineffective because most of the air will be forced around the sides of the mask, not filtered through the fabric. It will also be uncomfortable to wear, so you'll be tempted to take it on and off, which also makes it less effective. If the fabric is extremely easy to breathe through, consider a fabric with a denser weave or add a 3rd filter layer of flannel, felt, etc. inside. High thread count sheets are too hard to breathe through. Inexpensive sheets/pillowcases work well. Most, but not all, quilting cottons and cotton flannels work. Just try out what you have.
- Flannel is good. Lustig et al. provide evidence that two layers of cotton flannel filter about 95% of droplet-borne virus-sized particles. This may have to do with the fact that flannel has both a grid-like woven layer and a fuzzy layer where the threads are randomly arranged.
- Quilting cotton is pretty good too. Two layers of quilting cotton (think cotton bedsheets) filtered about 90% of particles according to Lustig et al.

- Felt can be useful as a filter layer. Lustig et al. didn't test felt, but I have tried a layer of synthetic craft felt between two layers of low-thread-count cotton. This was nice because the felt made the mask stiffer, preventing it from collapsing slightly against my mouth when I inhaled. (Note: felt worked better than quilt batting.) Test the fabric sandwich to make sure you can breathe through it before you make the mask. I would **not** recommend a mask made of felt alone, because I don't think it would filter well and because it would self-destruct in the washing machine.
- Denim is not a good choice. It does a bad job at filtering particles (see Lustig et al.) and it's hot and heavy.
- Fit matters. If air passes through gaps around the sides/top of the mask, the mask doesn't do as good a job. Healthcare workers often get their N95 masks professionally fitted. For the rest of us, choose a mask design, like ragmask.com's or mine, that lets the mask fit against your face all around. I am not a fan of surgical-style masks for this reason, though any mask is better than none.

Stay well! The instructions begin on the next page. Feel free to forward these instructions to others.

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The following instructions make 1 adult-size mask. See below for child sizes.

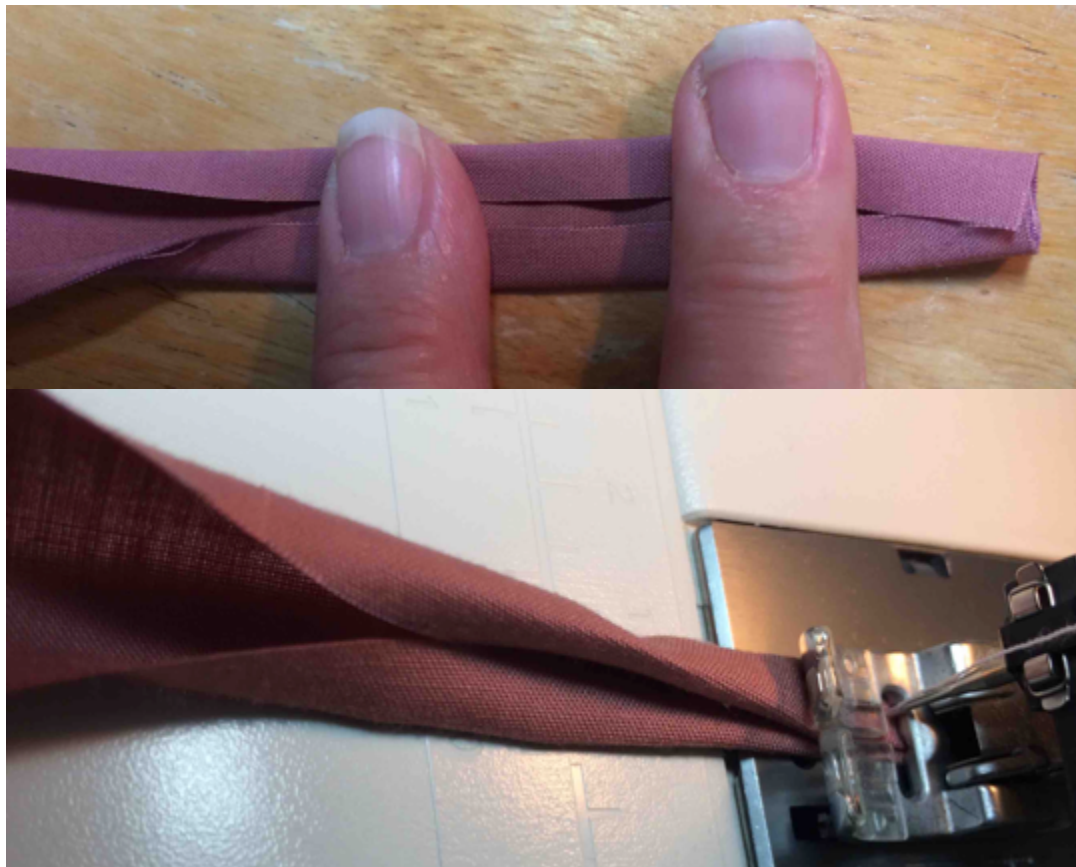
Cut out the fabric:

Cut out the following:

- One 10 x 12 inch rectangle. This is for the main part of the mask.
- Four 18 x 1 1/8 inch pieces for the straps. The exact width isn't important here; 1 1/4 inch would work fine too. If you make it narrower than 1 inch it will be fiddly and annoying to sew. Note: if you're making the main part of the mask out of flannel, I suggest choosing quilting cotton or some other densely woven, non-stretchy fabric for the straps because flannel frays too much.

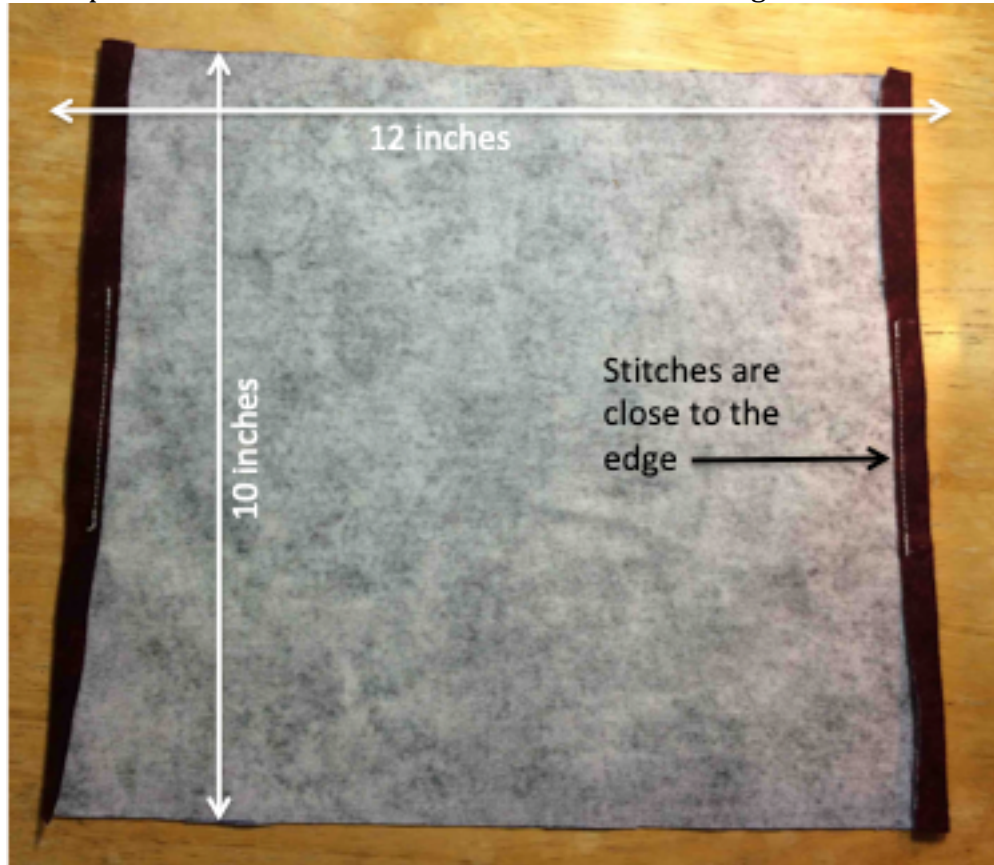
Make the straps:

1. Start at one end of the piece of fabric. Fold both sides in to the center, then fold the whole thing in half again. Now you have a strap about 1/4 inch wide and 4 layers thick. Just fold the first couple of inches for now.
2. Sew along the strap to hold the layers together. Continue along the length of the strap, sewing as you go. You don't have to iron or pin this in advance.
3. Repeat for the other three straps.



Make the main part of the mask:

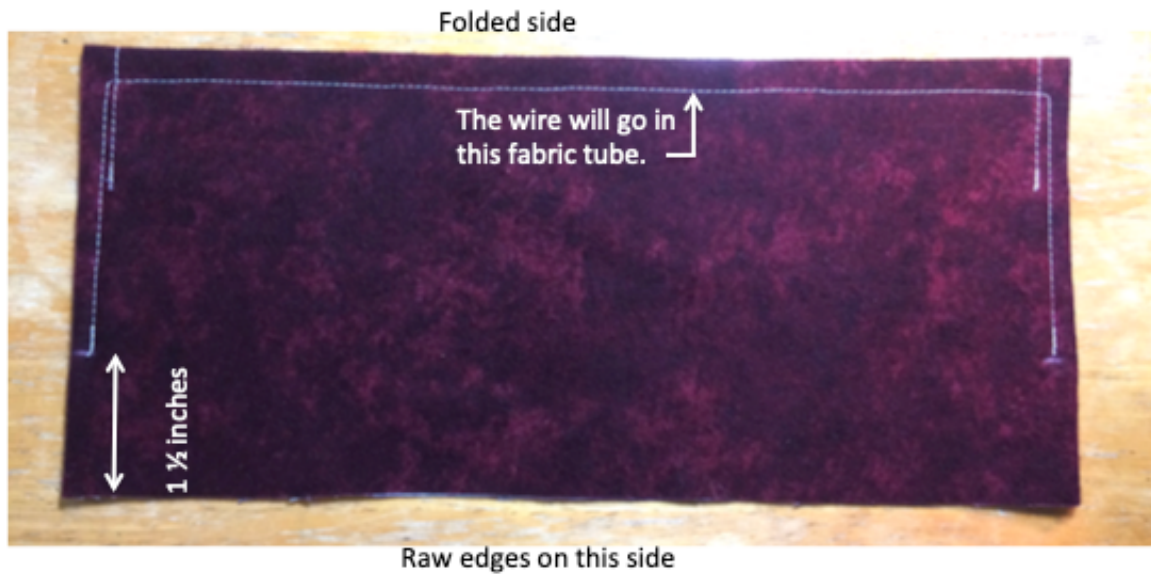
1. Lay the big rectangle of fabric “wrong” side up. Fold over a flap of fabric, about ½ inch wide, on each of the **short** sides. Iron or finger-press or pin the flaps down.
2. Stitch a few inches in the middle of each flap to hold them down. The exact placement doesn’t matter; you just need the middle few inches of the flaps attached. Place your stitches near the edge of the flaps. This stitching will prevent the flaps from making a little “pocket” in the finished mask where the wire can get stuck.



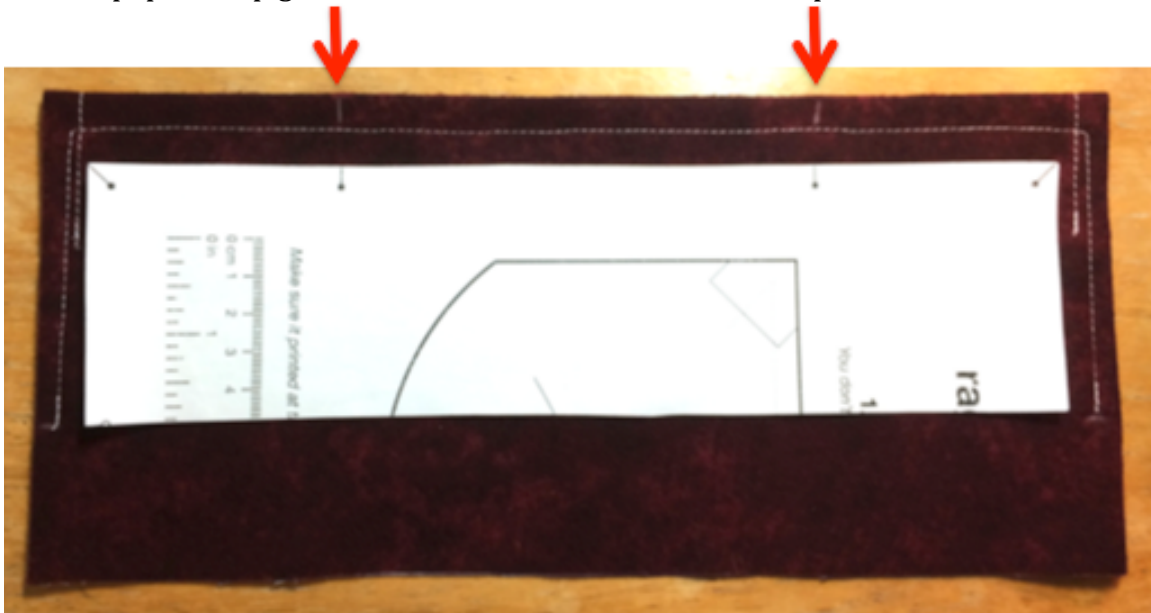
3. Fold the top half down to cover the bottom half, producing an 11 x 5 inch rectangle.



4. Sew along 3 edges, using an approximately $\frac{1}{4}$ inch seam allowance along the sides and $\frac{3}{8}$ " along the top. It doesn't have to be exact, but the tube along the top edge has to be wide enough for the wire to easily slide in. Leave a gap of $1\frac{1}{2}$ inches between the end of the seam and the raw edges of the fabric.



5. Use the paper strap guide to mark where the two inner straps will be attached.



6. Sew one strap onto each top corner and one strap onto each marked inner position. Be careful not to sew into the tube at the top — if you do, you won't be able to slide the wire in later.



7. Fold the mask in half from right to left so the straps are inside.



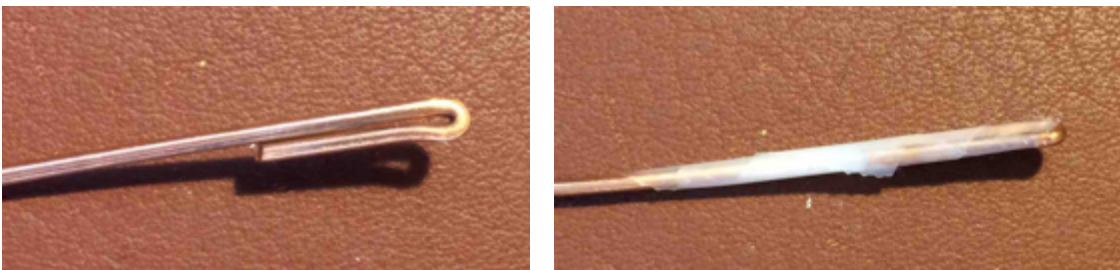
8. Mark the fabric using the semicircular paper template (note the orientation). Sew along the marked line, starting from the right side. Cut away the remaining fabric.



9. Turn the finished mask inside out. You will notice that straps are attached to the outside of the mask. This is a good thing! Yes, it looks slightly less elegant, but it improves the fit of the mask to your face and also makes the mask more comfortable to wear.

Make and insert the wire:

1. Cut an 8 inch piece of bendable wire. I have had good luck with 18 gauge copper or aluminum wire. If you're ordering online, search for "hobby wire," but start by asking your friends what they have in their junk drawer or garage!
2. Bend each end of the wire over. Wrap a piece of tape around the end. These steps will make it easier to slide the wire into and out of the mask.



3. Slide the wire into the fabric tube along the top of the mask. Center the wire and bend it to fit your nose.

Washing the mask:

Machine washing works fine for the fabrics I have used: flannel, quilting cotton, and quilting cotton with a layer of felt or flannel inside. I recommend putting the mask in a mesh bag so the straps don't strangle the washing machine. **Remove the wire before machine washing.**

Kid sizes:

Size Medium (ages 9-13):

Follow the directions for the adult mask. In step 8 of “Making the main part of the mask,” after you mark the line from the template, mark a second line about 3/8 inches above the first. Sew on the second (upper) line and cut on the first (lower) line.



Size Small (ages 6-8):

Follow the directions for the adult mask, with the following changes:

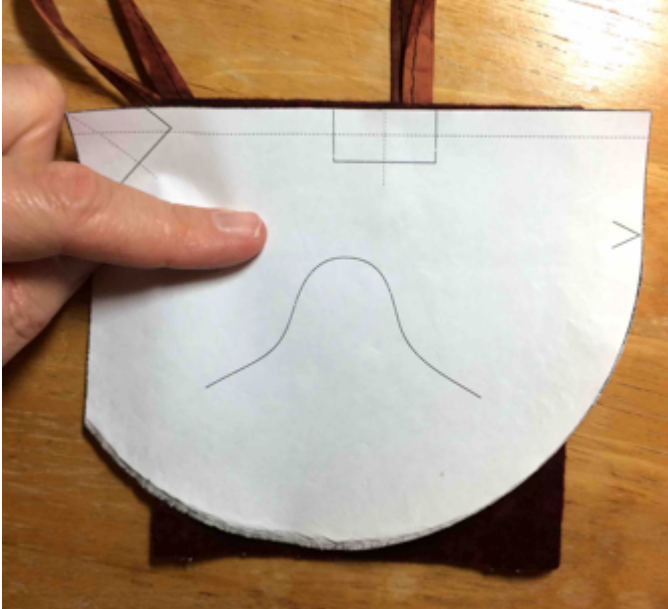
- For the main part of the mask, cut out a rectangle 10 x 11 inches.
- In step 1, when you fold in the flaps, you will still fold in the **short** sides. After folding them in, you will have a 10 x 10 square.
- In step 5, mark the positions for each inner strap about half an inch closer to the center.
- In step 8, line up the **right** side of the semicircular template with the edge of the fabric, letting the **left** side overhang the fabric.
- See the picture for the Medium size mask above: Mark the curved line on the fabric. Then mark a second line about 3/8 inches above the first. Sew on the second (upper) line and cut on the first (lower) line.
- Cut the wire about an inch shorter than for the adult mask.

Size Extra-Small (ages 3-5; might fit a 2-year-old too. Children under 2 shouldn't wear masks because of the suffocation risk):

Follow the directions for the adult mask, with the following changes:

- For the main part of the mask, cut out a rectangle 9 x 9 inches.
- In step 1, after folding in the flaps, you will have an 8 x 9 rectangle. Orient it with the flaps on the sides, as shown in the picture for the adult mask.
- In step 3, fold the top half down just as you would for the adult mask, producing an 8 x 4 ½ inch rectangle.

- In step 5, center the paper strap guide on the mask (it will overhang the sides). Mark the position for each inner strap about $\frac{3}{4}$ inch closer to the center than the marks on the paper.
- In step 8, position the semicircular paper template so that the left and right sides overhang the fabric equally.



- See the picture for the Medium size mask above: Mark the curved line on the fabric. Then mark a second line about $\frac{3}{8}$ inches above the first. Sew on the second (upper) line and cut on the first (lower) line.
- Cut the wire about $1\frac{1}{2}$ inches shorter than for the adult mask.

Variation: Adding an inner filter layer.

If you want to add a third layer of filter fabric inside the mask, such as felt or flannel, do the following:

- Cut a piece of filter fabric to be the same size as the rectangle in step 3, except $\frac{3}{8}$ inches narrower along the short dimension. For example, for an adult mask, the rectangle in step 3 is 11 x 5 inches, so you would cut a piece of filter fabric to be 11 x 4 $\frac{5}{8}$ inches.
- In step 4: Instead of sewing one seam along all three sides, just sew one seam along the top, about $\frac{3}{8}$ inches from the top folded edge, all the way from left to right. Open up the mask and lay the filter fabric inside, nestling it up against the top seam. Close the mask again.
- Now sew the side and top seams as in the original version of step 4, except make the top seam about $\frac{3}{8}$ inches below your first seam. This holds the filter fabric in place.