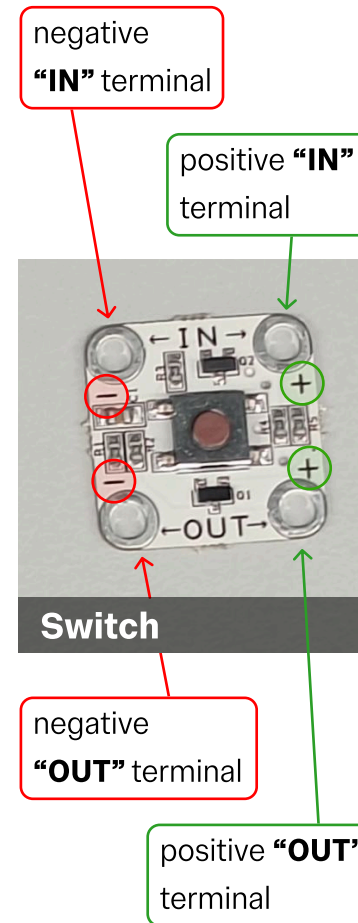
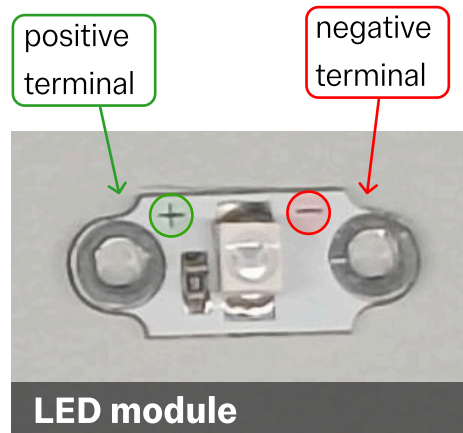
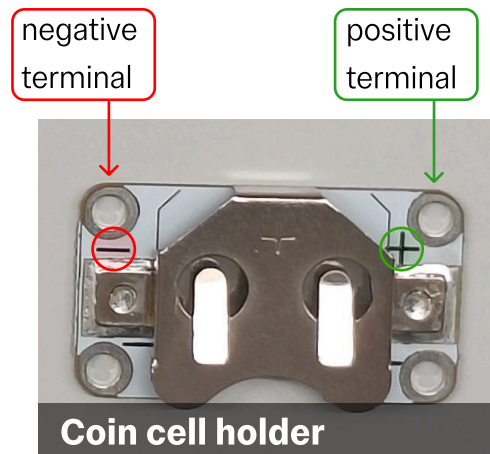
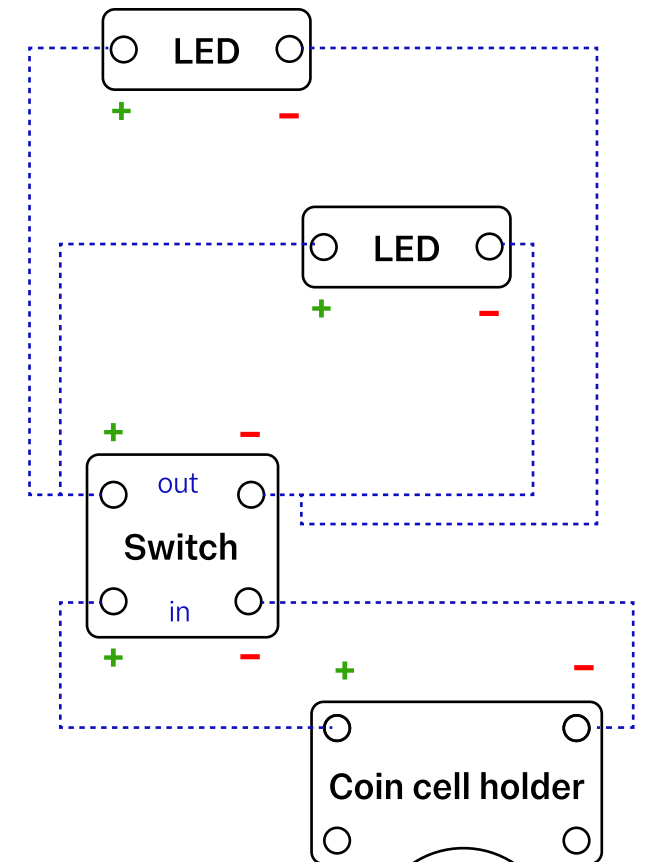


ACTIVITY C: sewing 2 or more LEDs with a switch

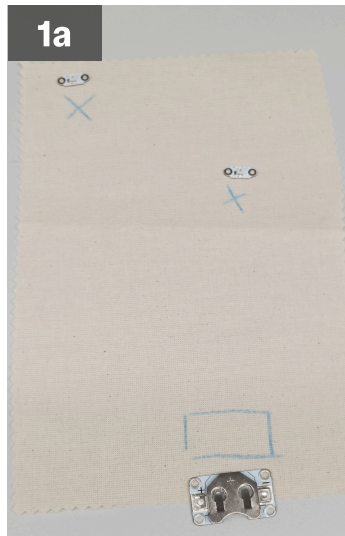
E-textile Components:



Circuit diagram:

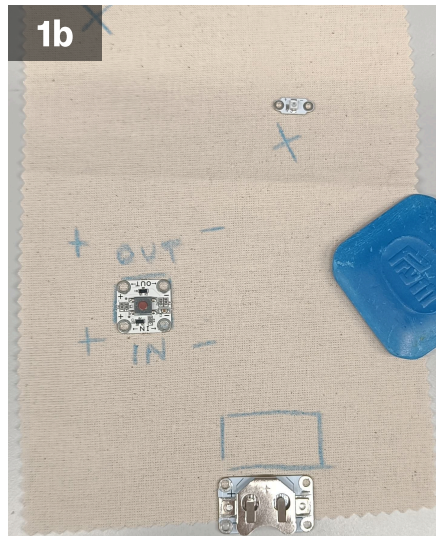


1. Trace out your circuit onto your fabric



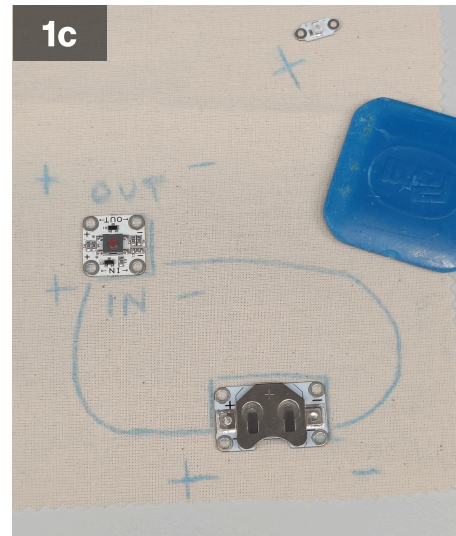
Draw a cross with a chalk pencil where you want to place the LEDs.

Next draw a box where you want to place the cell holder.



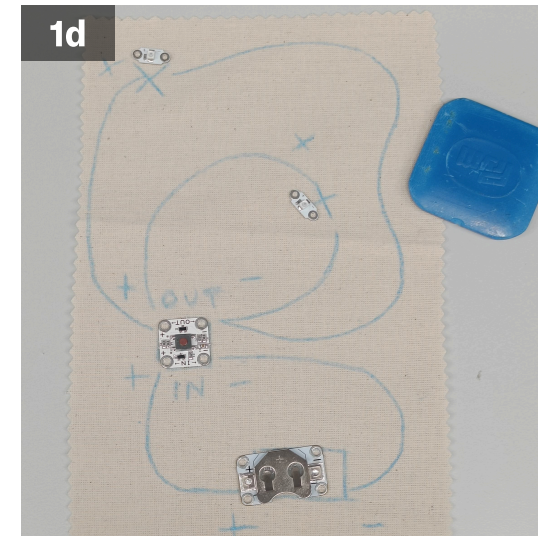
Near the cell holder, draw another box where the switch will go.

Mark **'in' on the side closest to the cell holder**, and **'out' on the other side** of the switch along with the marked **+ and - signs**.



Look at the positive and negative marks on the cell holder, then **draw those + and - signs on the fabric**.

Draw a line to join the **+ cell holder with + 'in' switch side**, and the **- cell holder with the - 'out' switch side**.

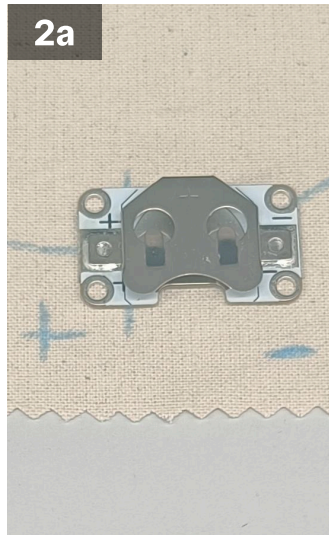


For each LED:

Draw a line connecting the + 'out' hole of the switch to one side of the LED. Mark that LED side with a + sign.

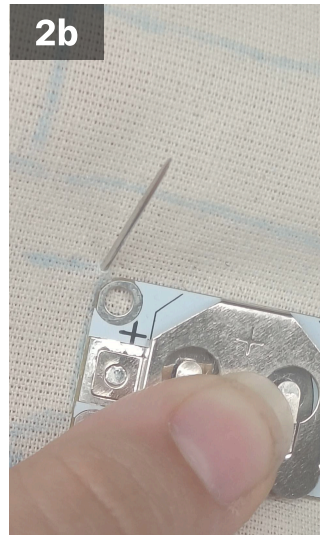
Do the same for the - 'out' hole of the switch to connect to the other side of the LED. Mark that LED side with a - sign.

2. Sew the coin cell holder to your fabric



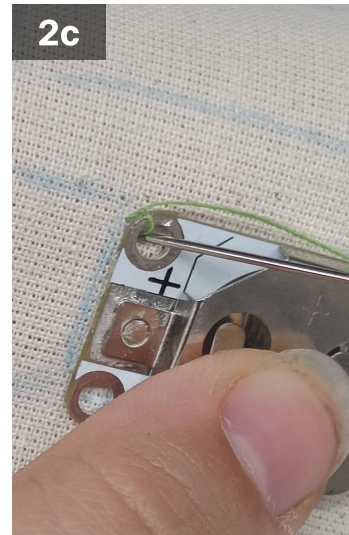
Check coin cell holder for **positive** and **negative** markings.

Place the cell holder on the fabric so these match up with your drawings.



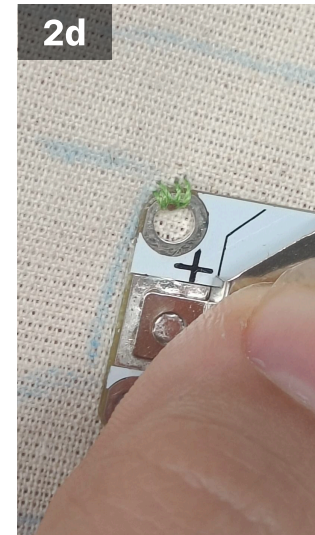
Thread your needle with **regular cotton thread**.

Bring your needle up from the back of the fabric near one of the **+ marked holes**.



Take your needle down into the **+ hole of the cell holder**.

This sews a tight loop around that terminal (hole).



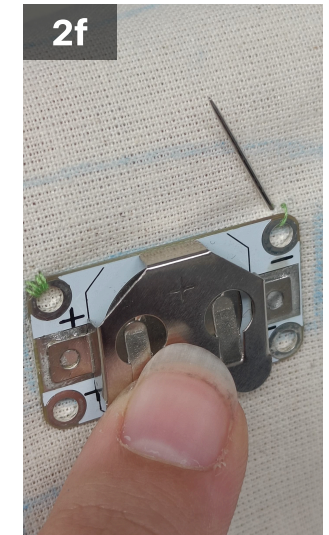
Sew 4 more loops around the hole.

There should be **5 tight stitches** around the positive terminal holding it down.



After sewing one side, **tie off on the back and cut your thread**.

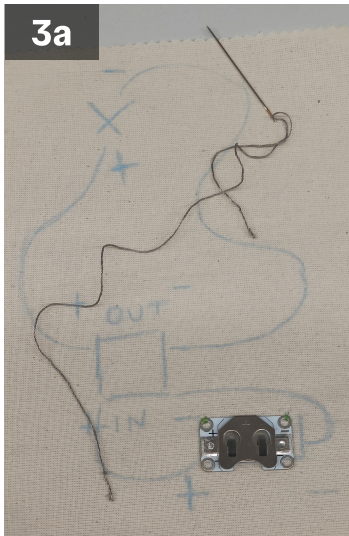
Make sure your knots are tight and can't be undone easily.



Rethread your needle and repeat on the other side.

Make sure you are sewing through a **negatively** marked hole this time.

3. Start making a circuit from the cell holder



Now work with the conductive silver thread!

Thread your needle with the e-textile thread. Create 3 secure knots at the end of the thread.



Find the **positive cell holder** hole you haven't sewn down.

Bring your needle up from the back of the fabric by the hole.



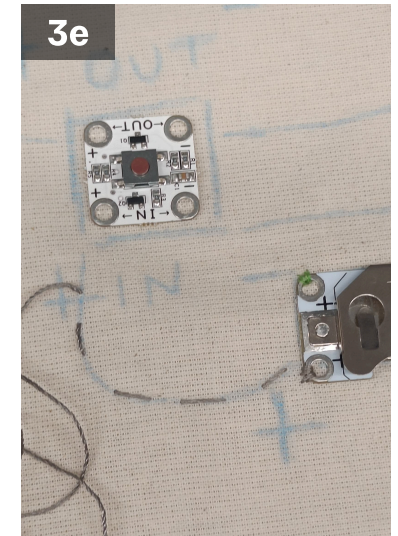
Take your needle down into the **+ hole of the cell holder**.

This sews a tight loop around that terminal (hole).



Stitch 4 more loops close together around the circular hole. You should build up a thick thread connection to the metal.

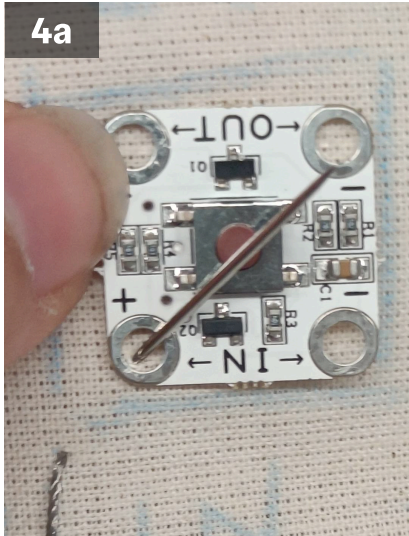
Do not tie off yet!



Sew **running stitches** along the path you have drawn towards the switch marking.

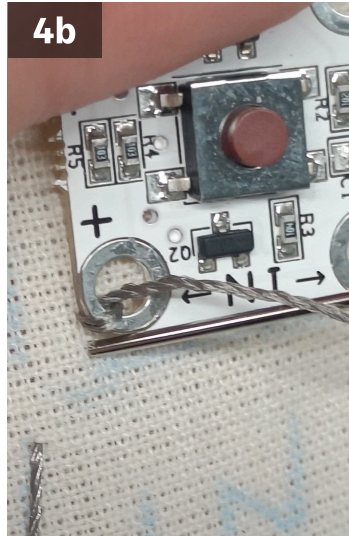
Stop when you reach where you want to sew down the switch.

4. Sew the positive 'in' side of the switch down

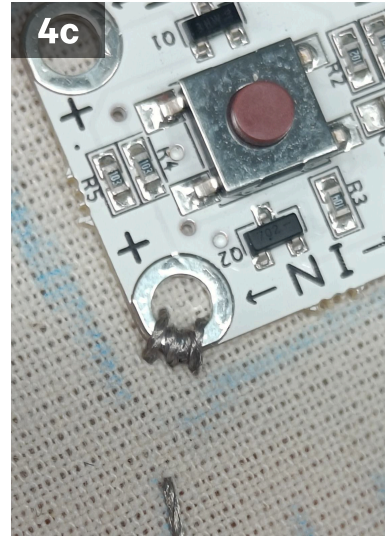


Hold the switch down with the '**in**' side **facing the cell holder**.

Bring your needle up from the back of the fabric through the **positive 'in' hole** of the switch.



Bring the needle back down outside of the hole to sew a **tight loop around the edge**.



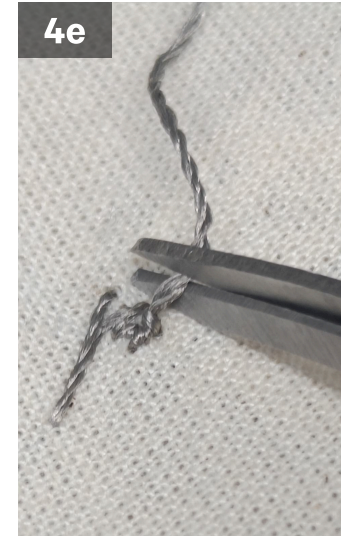
Sew **4 more tight loops** around the edge of hole.

There should be 5 tight loops in total.



On the back side, sew **3 tight knots** to finish off your thread.

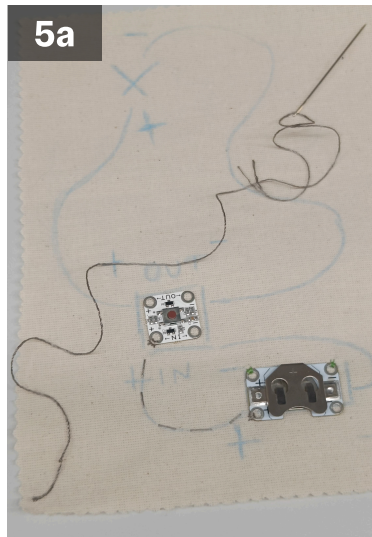
Keep these knots very tight to stop the thread coming loose.



Cut the end leaving only a **very short tail** of loose thread.

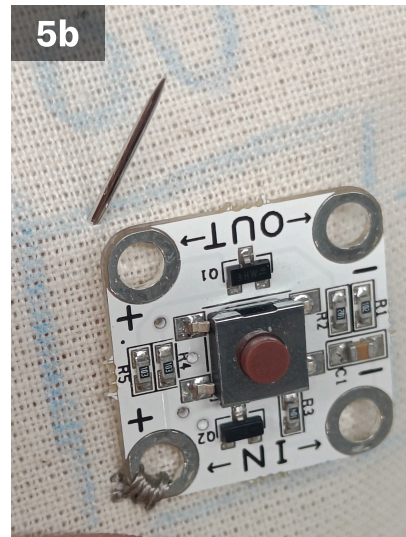
It's important to keep this short to avoid it touching other parts of your sewn circuit.

5. Sew the positive 'out' side of the switch down



Re-thread your needle with **conductive thread**.

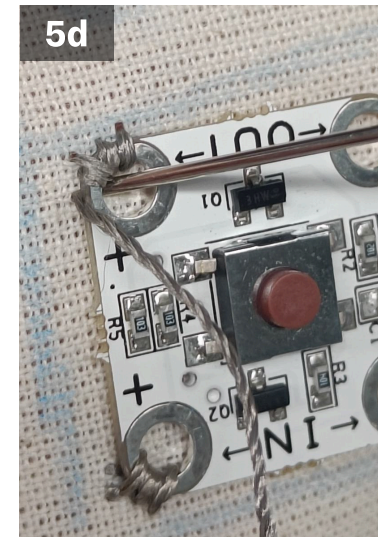
Tie 2 tight knots at the end ready to start sewing again.



Bring your needle up through the fabric **near the positive hole** of the switch on the **'out' side**.



Bring the needle down **into the positive 'out' hole** to sew a tight stitch.



Sew **4 more tight loops** around the positive out hole in the switch module.

There should be 5 tight loops in total.



Continue sewing in **running stitch**.

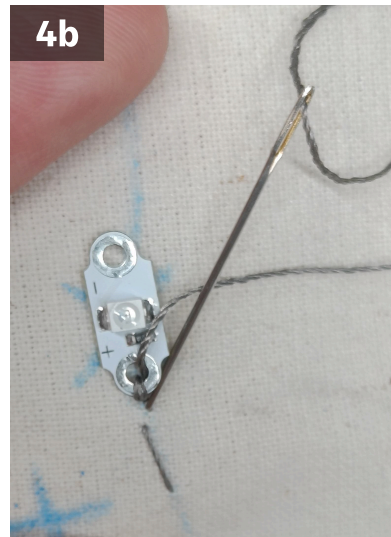
Stop when you reach the cross you drew for the LED marking.

4. Sew the positive LED terminal



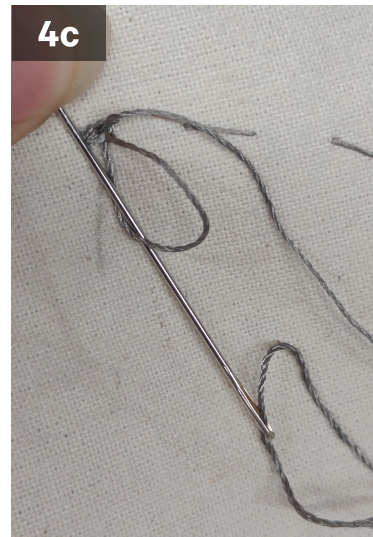
Look at the markings on the LED and **find the positive side**.

Align this with your markings on the fabric and place the LED in the position you want.



Stitch **5 tight loops** around the edge of the positive terminal.

Make sure all the stitches are **grouped together** to build a secure connection to the LED.



On the back of the fabric, sew **3 tight knots** to finish off your thread.

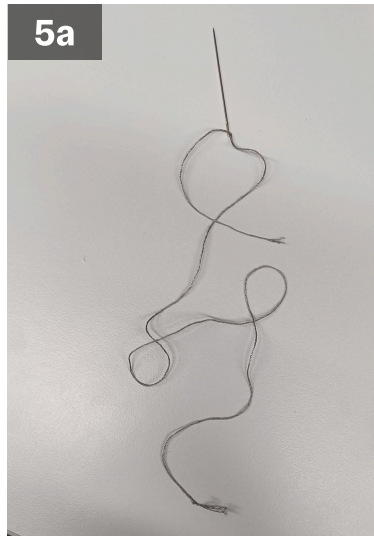
Keep these knots very tight to stop the thread coming loose.



Cut the end leaving only a **very short tail** of loose thread.

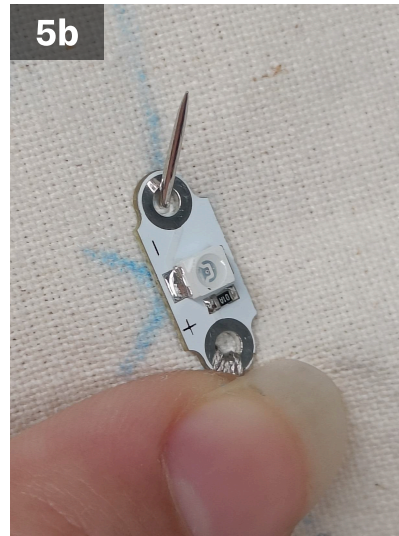
It's important to keep this short to avoid it touching other parts of your sewn circuit.

5. Sew the negative LED terminal



Re-thread your needle with another **20-30cm of conductive thread**.

Tie secure knots in the end to prepare for starting a new section of sewing.

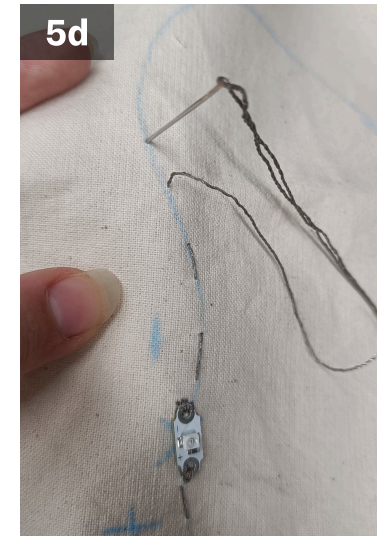


Insert your needle from the back side of the fabric, coming up through the **negative terminal of the LED**.



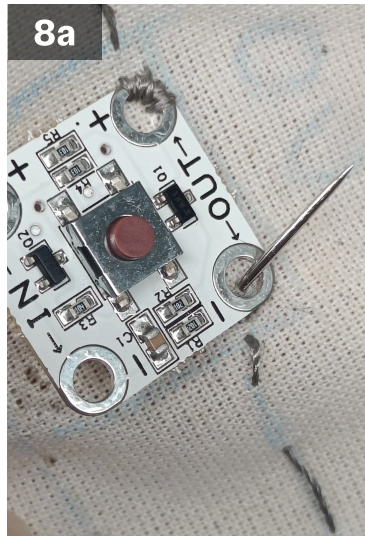
Stitch **5 tight loops** around the negative terminal building a secure connection.

The LED should be tightly held onto the fabric now through both holes.

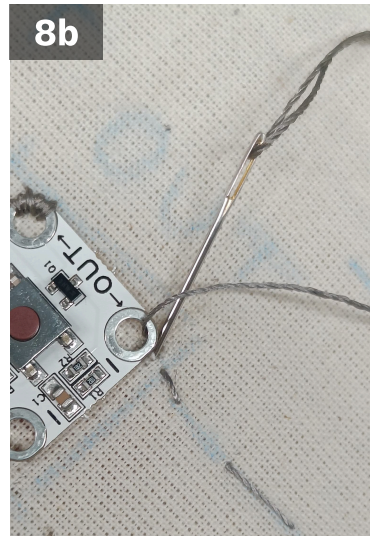


Continue sewing along your drawn path in **running stitch** back towards the switch.

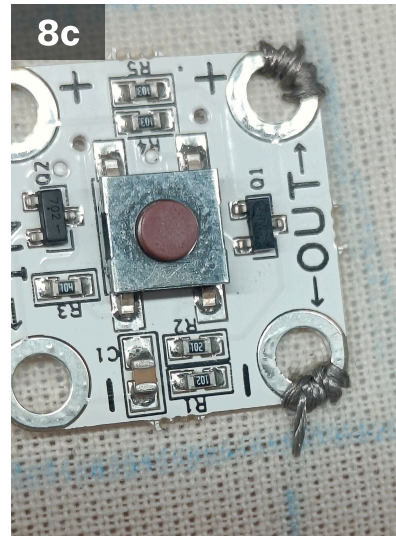
8. Sew the negative 'out' side of the switch down



Bring your needle up from the back of the fabric into the **negative hole** on the 'out' side of the switch.

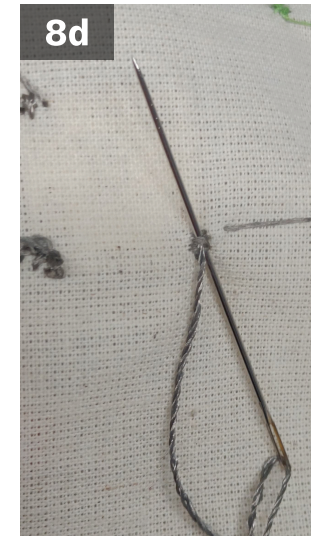


Bring the needle back down through the fabric outside of the hole to sew a **tight loop around the edge**.



Sew **4 more tight loops** around the edge of hole.

There should be 5 tight loops in total.

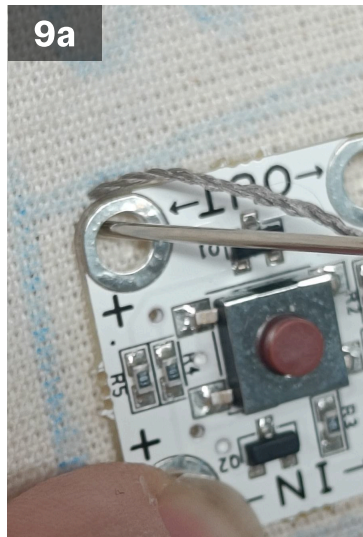


Turn the fabric over. On the back side **sew 3 tight knots** to finish off your thread.



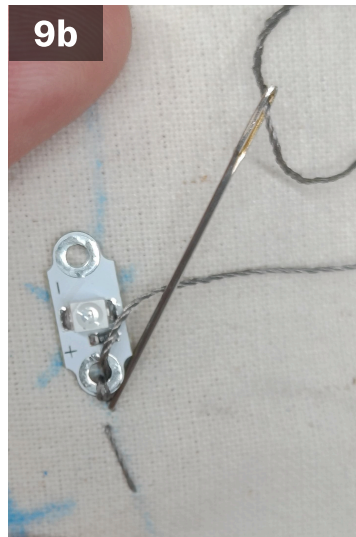
Cut the thread **very short** making sure it doesn't touch any other sewn paths.

9. Adding more LEDs



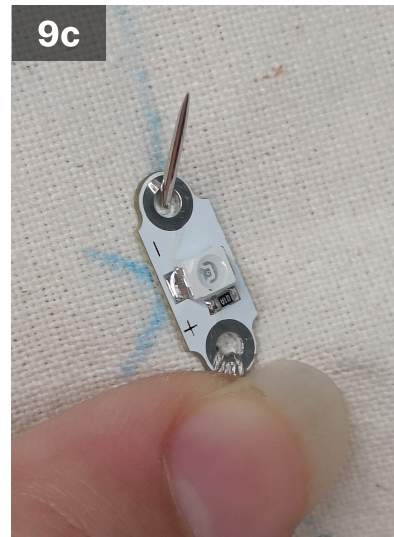
Rethread your needle with a new length of conductive thread.

Repeat step 5 joining onto the **positive out hole of the switch**.

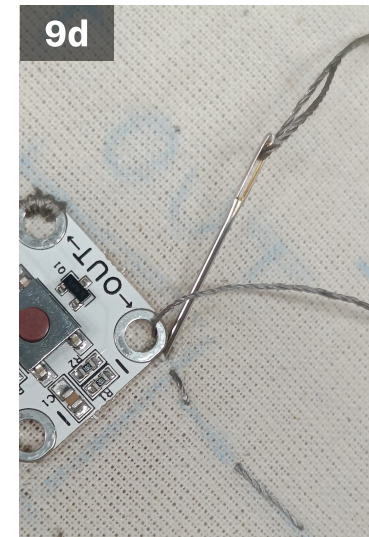


Repeat step 6, sewing towards where you want to add the second LED.

Sew down the **positive side of the new LED** then tie off.

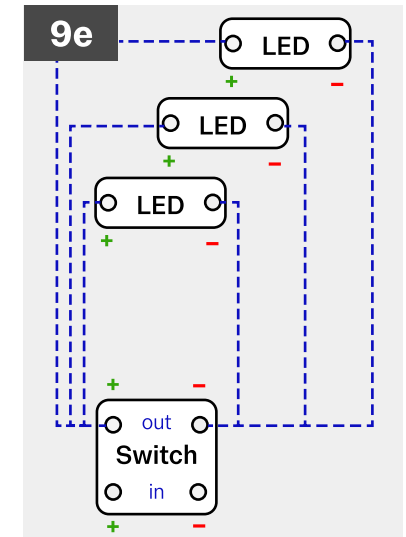


With a new length of thread, **repeat step 7**. Sew down the **negative LED hole** then sew in running stitch back towards the switch.



Repeat step 8, sewing a connection to the **negative out hole of the switch**.

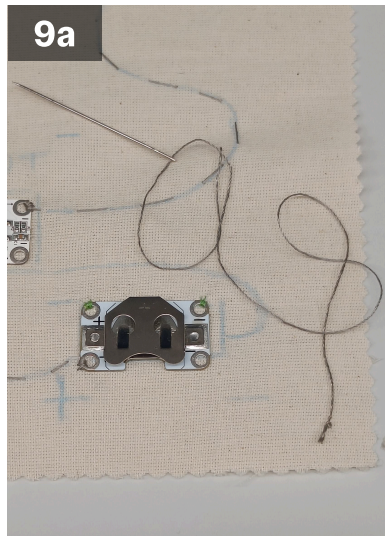
Knot and tie off your thread.



Keep repeating **steps 5-8** for **every new LED** you want to add.

Make sure **none of your thread lines cross!** The additional LED paths must go around the previous stitching.

9. Sew the negative 'in' side of the switch down

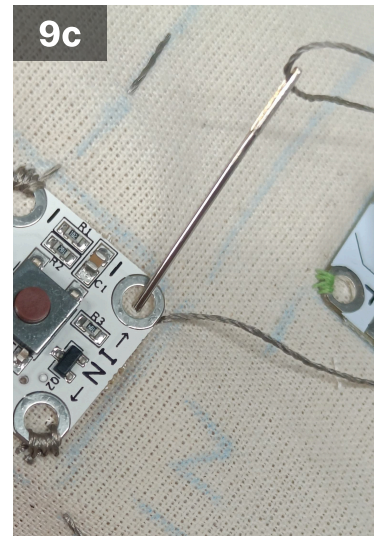


Re-thread your needle with conductive thread.

Tie 2 tight knots at the end ready to start sewing again.

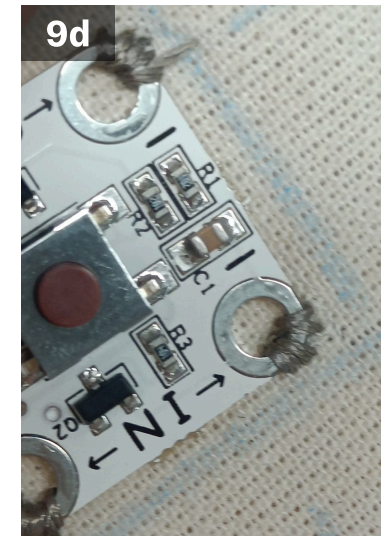


Bring your needle up through the fabric near the **negative hole of the switch on the 'in' side.**

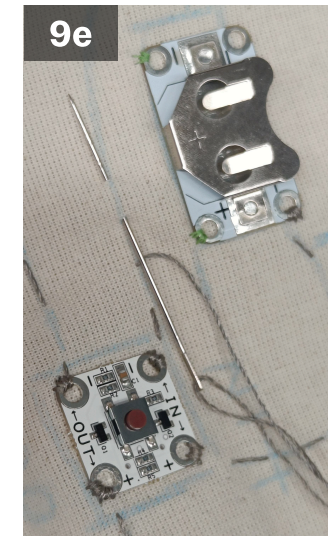


Bring the needle down through the fabric into the negative 'in' hole.

This sews a tight stitch around the hole.



Sew 4 more tight loops around the negative in hole in the switch module.



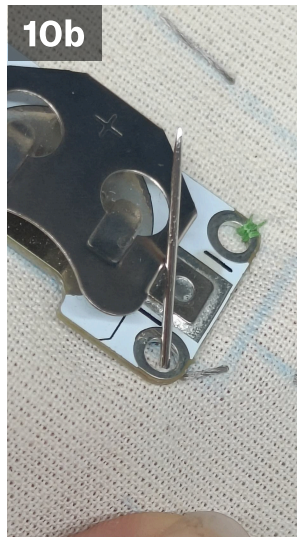
Continue sewing in running stitch along the path towards the cell holder.

10. Closing the circuit

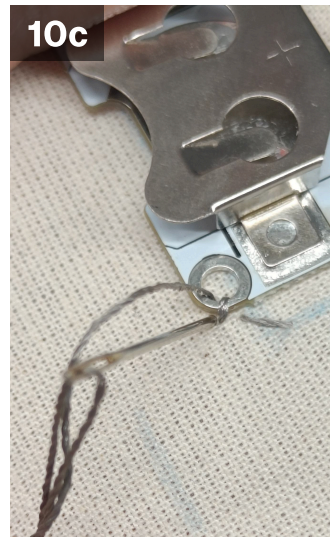


Finish sewing running stitch along your drawn line to reach the coin cell holder.

Check that this is the **negative terminal!**



Bring your needle up from the back of the fabric through the fabric into the hole.

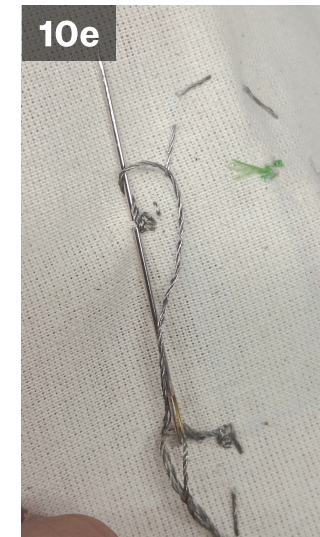


Bring the needle down through the fabric into the negative cell holder hole.

This sews a tight stitch around the hole.

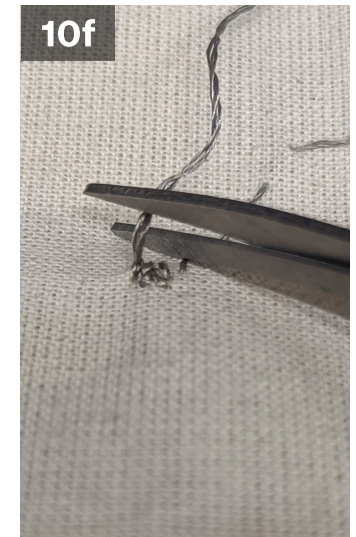


Repeat 4 more times to sew a total of **5 tight loops** around the hole.



Turn over the fabric to the back, and stitch **3 tight knots** with the thread.

Keep the knots tight to stop the thread coming loose.



Cut the end of the thread leaving only a **very short tail**.

Remember to keep this short to avoid it touching other parts of your sewn circuit.

Observations

Insert the coin cell into the holder on your fabric, making sure the + on the battery is facing up.

Make sure to turn your switch on so your circuit is active!



You have now sewn an electrical circuit!

Use these questions to **observe what is happening** and why you think that might be:

1. What happens when the battery is added?

2. Can you try to explain in a sentence what is making this happen using the words “voltage” and “current”

3. Look at someone else’s circuit sat near you. Can you name one similarity and one difference you can notice?

4. Measure the length of your sewing path and someone else’s and think if you can link this to any differences you see.