

3D Printer Certification

**Learn to use the library's
printer yourself!**



newmarket
library

Anything and Everywhere

Who can get certified to use the 3D printers at NPL?



- Have an active Newmarket Library account ([get a card here](#)).
- Be an adult (18+) or a student (14+) with the consent of a guardian.
- Be able to understand and follow safety rules.
- Prioritize personal safety and safety of others.
- Be able to confidently and safely operate the equipment.

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- Book a demo to show us your skills

Part 5 - Make a Booking

- Book an appointment to make your DIY 3D print

Part 1

Learn about the 3D printers

Why become certified to use the 3D Printers?



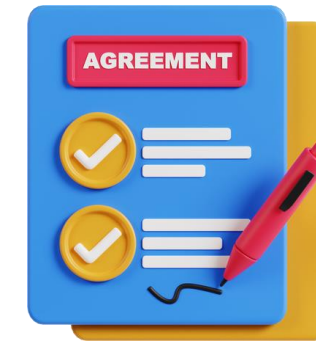
- Touch and use the 3D printers yourself!
- Try out a 3D printer before buying one!
- Learn by doing!
- Improve your 3D printing skills by preparing files (slicing), exploring techniques (how to do specific things), and troubleshooting problems.
- You don't have to worry about maintenance or supply management (the library manages all that!)
- Free do-overs on failed prints!

How to get certified to use the 3D printers?

- 01** Read through and watch this slideshow.



- 03** Sign the online Maker Hub Agreement Form



- 02** Take our quiz! (Retake as needed)



- 04** Book an appointment to do a test print from Certification menu.



([Maker-Hub booking - Newmarket Public Library](#))

Library card will be updated to add your 3D printer certification



Why is 3D printing important?

- **Innovation & Creativity:** Turns ideas into real objects through rapid prototyping and allows creation of complex designs that traditional manufacturing cannot achieve.



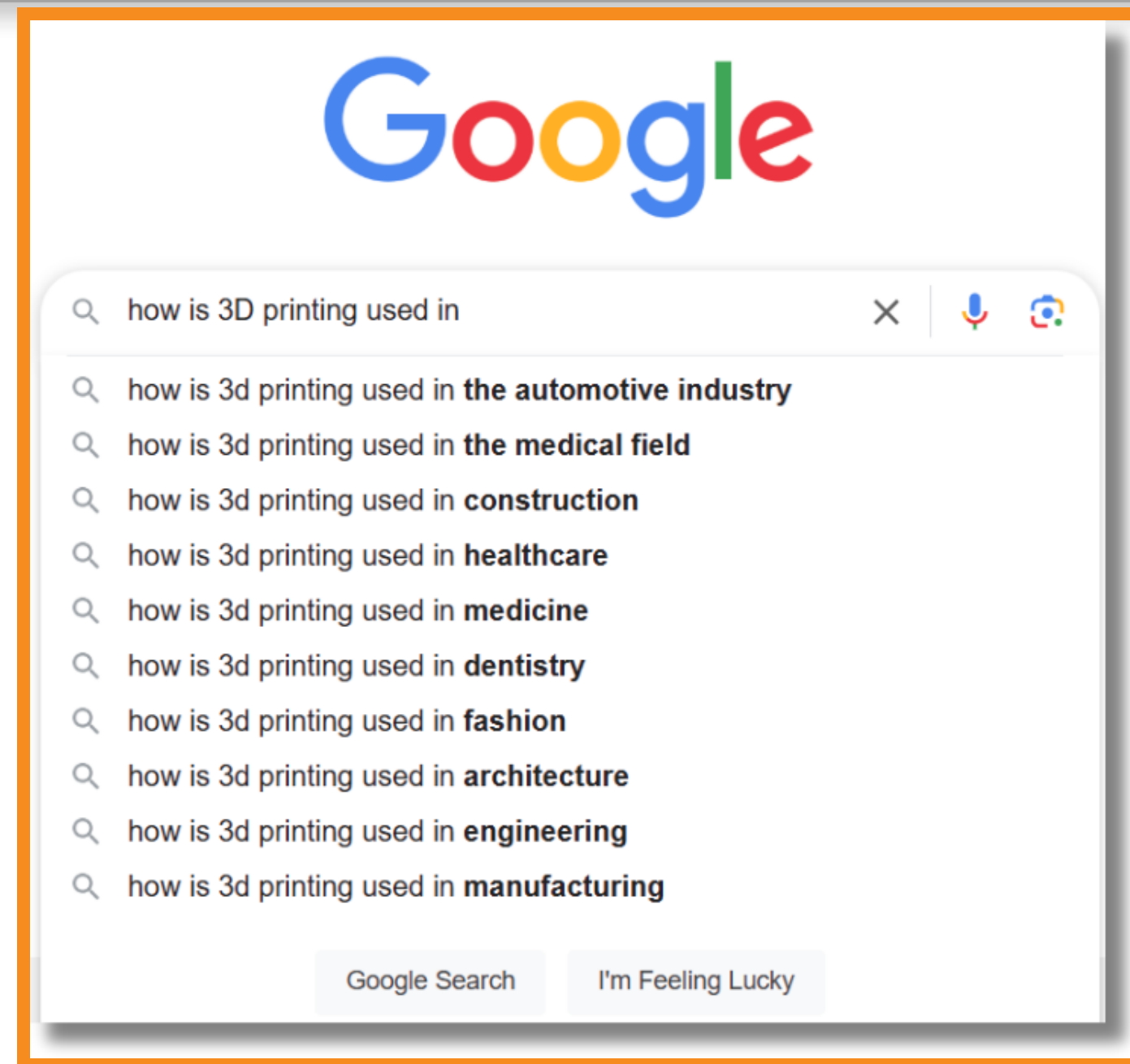
- **Accessibility and Customizability:** Makes manufacturing more accessible and customizable

- **STEM:** Encourages hands- on learning and problem-solving skills in science, technology, engineering and math. Learn about 3D printing in relation to your career path.

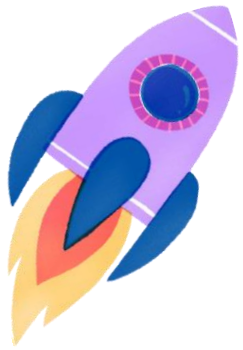
- **Sustainability:** Create or replace parts to extend a product's life.

How is 3D printing used in the world?

It seems like every industry in the world is using 3D printing



How is ____ industry using 3D printing?



SPACE EXPLORATION: 3D printed tools on demand



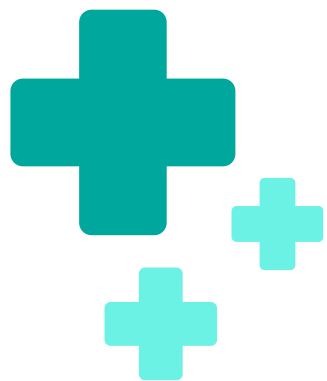
BAKERS: Printed icing on cakes, cookie cutters



ENTERTAINMENT: 3D printed models, props



FASHION: Printed fabrics and accessories



MEDICINE: 3D printed skin, organs, bone scaffolding



CONSTRUCTION: 3D printed houses, roads

So, what is 3D printing?



[What is 3D Printing](#)

Meet our 3D Printers

Different printer makes & models



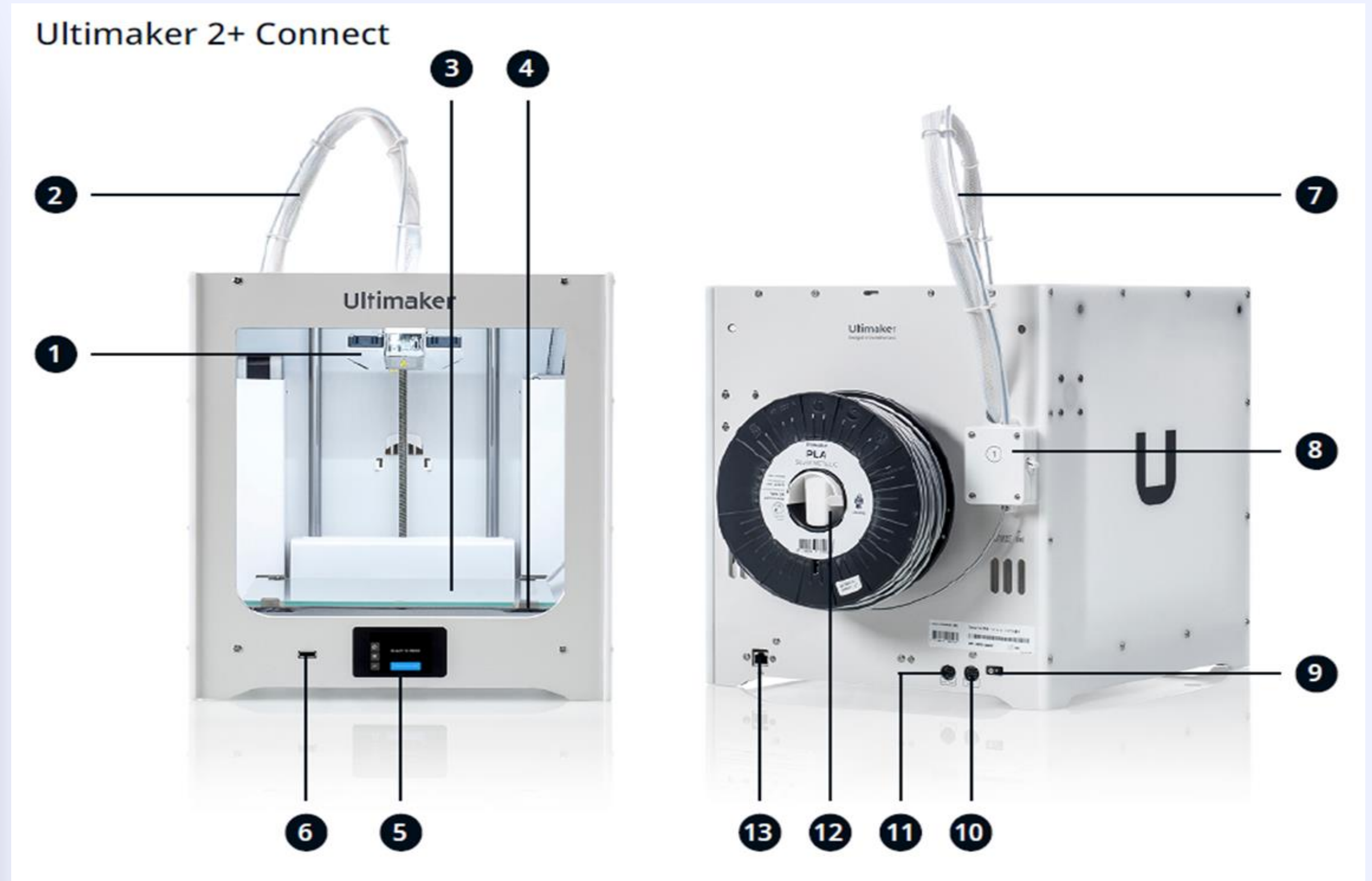
- When preparing a file to print, you need to set up the model of printer on which you will print.
- What models does NPL have? See our [Maker Hub page](#) for a full list.

In this course content, we will focus on the **Ultimaker 2+Connect** printer.

Parts of a 3D Printer

10/15

1. Print head
2. Print head cable
3. Build plate
4. Build plate clamps
5. Touchscreen Display
6. USB port
7. Bowden tube
8. Feeder
9. On/Off button
10. OUT port
11. Power Socket
12. Spool holder
13. Ethernet port



What material can 3D printers print with?

- 3D printing is only limited by the type of material you print with and the setup of the printer itself.
- Plastic and metal are common 3D printing materials. Often the material comes as filament rolled up on a spool.



**At Newmarket Public Library,
only PLA (Poly Lactic Acid) can be used.**

What do we 3Dprint with at the library?



**We only use spools of PLA
(Polylactic acid) filament.**

It is derived from plant products like corn starch or sugar cane. These plants undergo fermentation producing lactic acid, which is then polymerized to create PLA. It is biodegradable.

It is one of the easiest materials to 3D print successfully.

It's low melting point and minimal warping, makes it ideal for creating sharp corners.

It has low heat resistance, which is why it's not suitable for parts that may heat up.

PLA is the most common material used to print prototypes, figures, and fun desk toys.

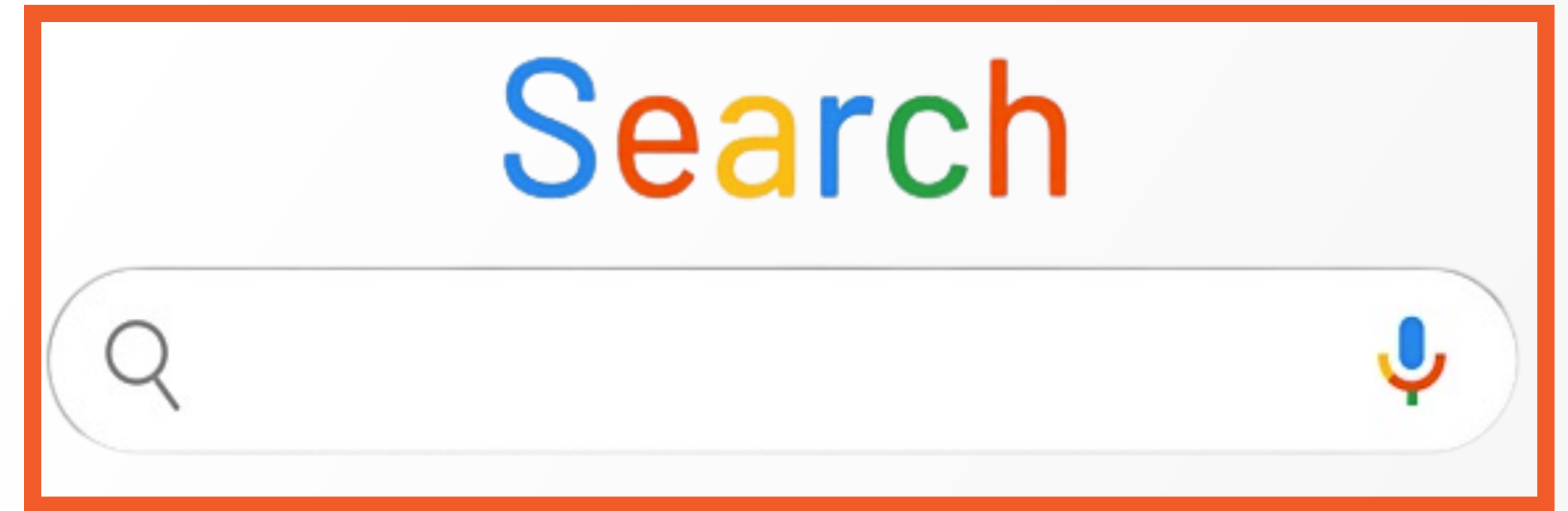
Find a file to 3D print

Make your own or find a shared design

Find a 3D model

- Many talented creators share their 3D designs with others, either for free or for a fee.
- See the library's Maker Hub page for a list of websites for finding 3D designs.
- Try <https://www.thingiverse.com/>
- Remember to look for files with the extension

.STL



List of websites for finding 3D designs

Websites for 3D printing models		
From sources across the web		
 Thingiverse	 Cults	 MyMiniFactory
 Pinshape	 TurboSquid	 CGTrader
 GrabCAD	 Thangs	 Youmagine
 Free3d	 NIH 3D Print Excha...	 Sketchfab
 Yeggi	 BodyParts3D	 Instructables
 Printables	 Stlfinder	 3D export
 NASA	 Repables	 SketchUp
 Cluts3d	 XYZprinting	 Redpah

Remember to look for
files with the extension
.STL

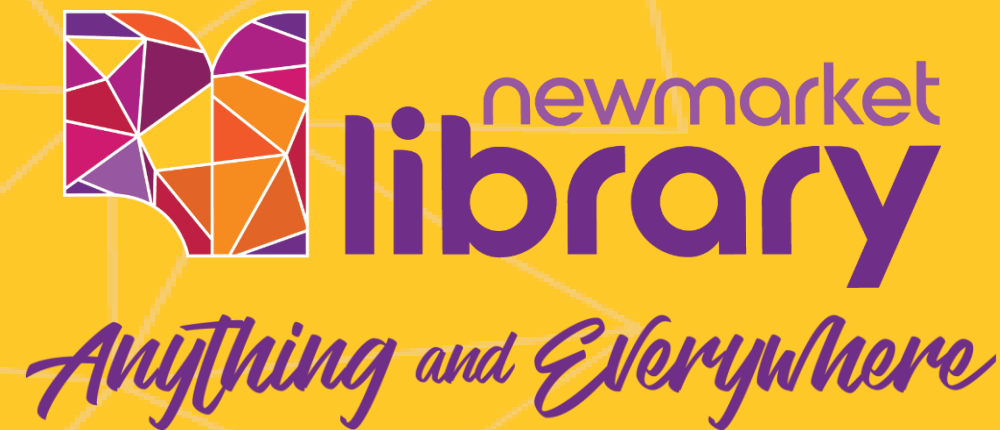
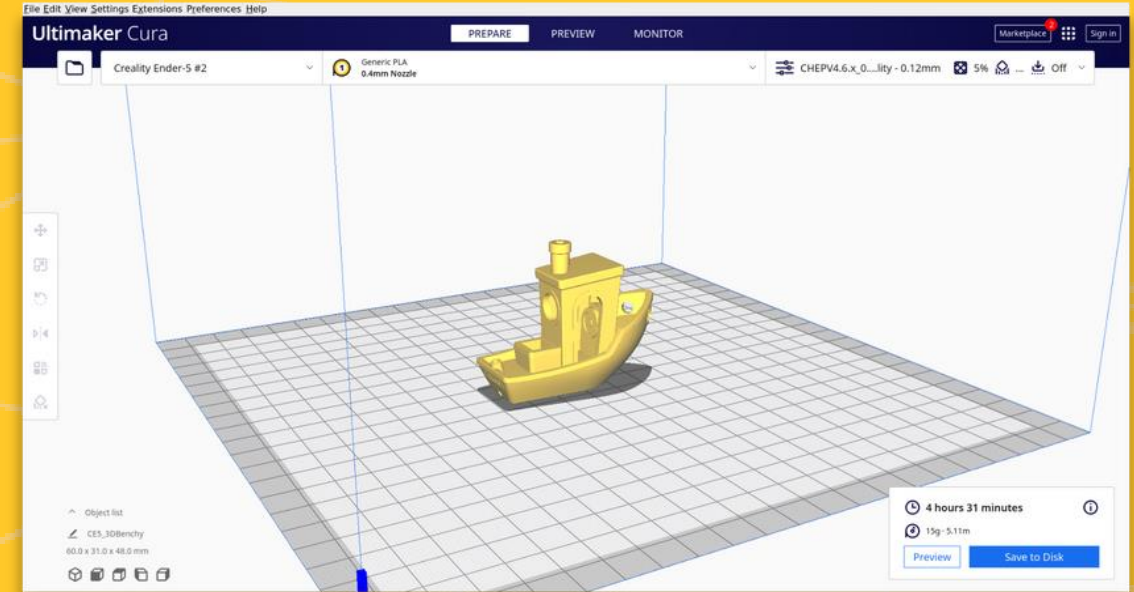
Make your own 3D model

- Design or modify a model in CAD (Computer Assisted Design). There are many free and paid options.
- [TinkerCAD.com](https://tinkercad.com) is good for beginners
- Learn from free lessons and tutorials online
- Design your model in metric (mm)
- Attend 3D Design classes at the library or book a 101 session.

Export files in **.STL** format.

Preparing a file to 3D print

Choose the right settings for a great print



Slicing Software

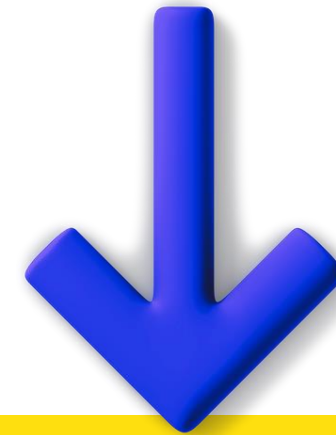
● What is Slicing?

Slicing is the process of breaking a design into many digital layers, creating a file instructing the 3D printer how to print.

i.e. layer height, infill, density, speed, build plate adhesion, temperature settings, supports for design, when to extrude molten material from the nozzle, and various other parameters.

● Slicing Software used at the library

We use **Cura** slicing software to prepare prints. You can set this up on your computer at home or use a computer at the library to prepare your prints. [Download Cura](#) and install on a computer.

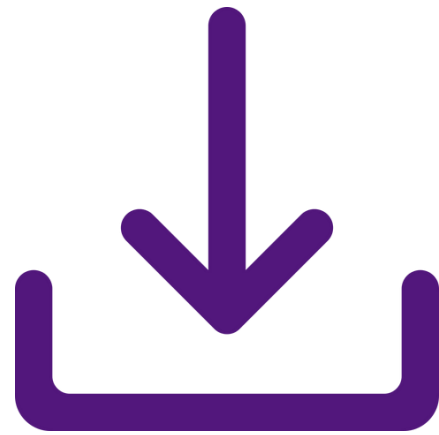


[Download Cura](#) and
install on a computer

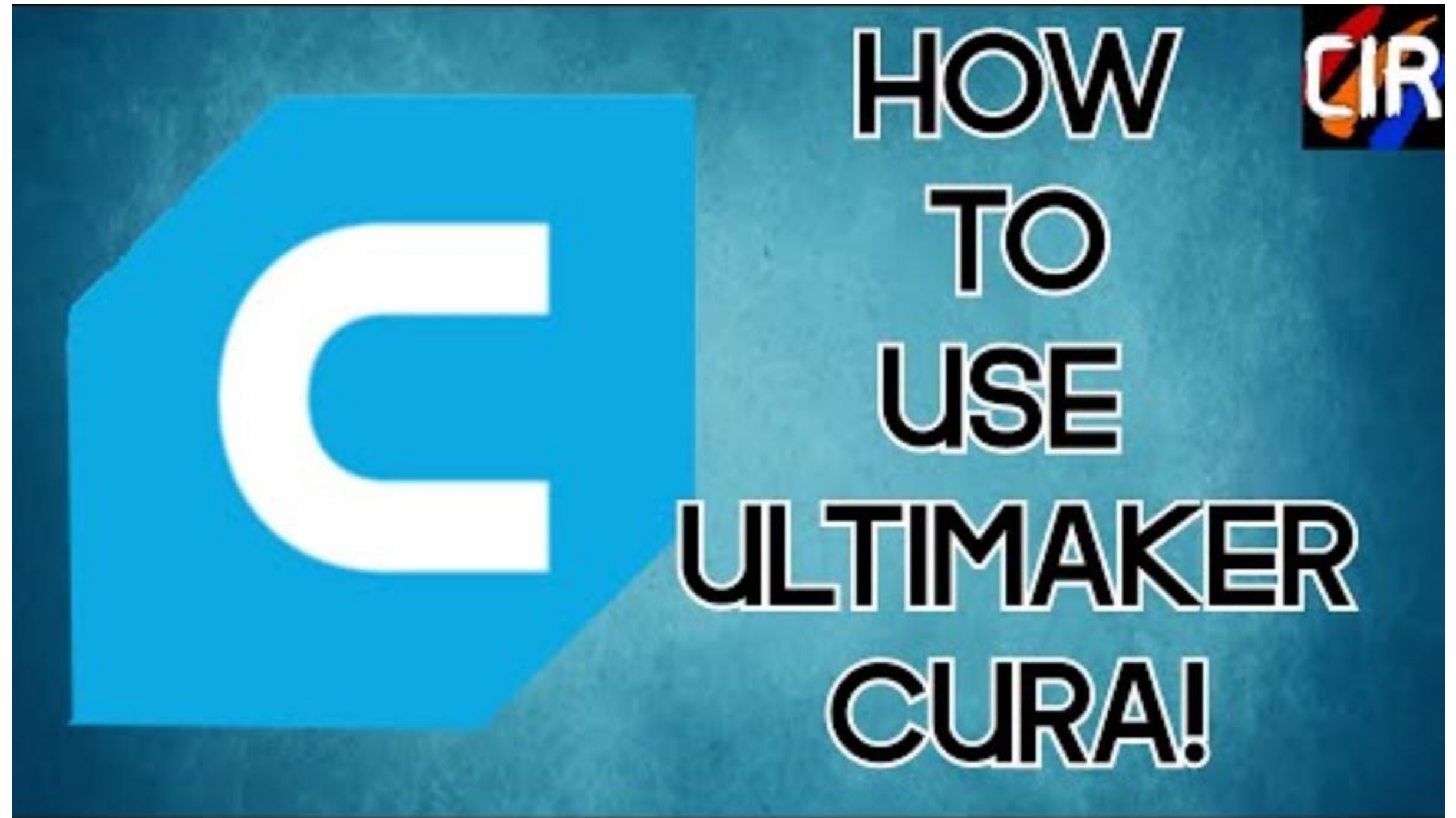


How to download & install Cura

● [Download Cura and install on a computer](#)



[Cura Installation video](#)



[Download Cura and install on a computer](#)

Key Considerations During Slicing

● **Select the Correct Printer profile**

Ensure that you've sliced the file for the correct 3D printer model, as using the wrong one can result in unreadable or incompatible G-code.

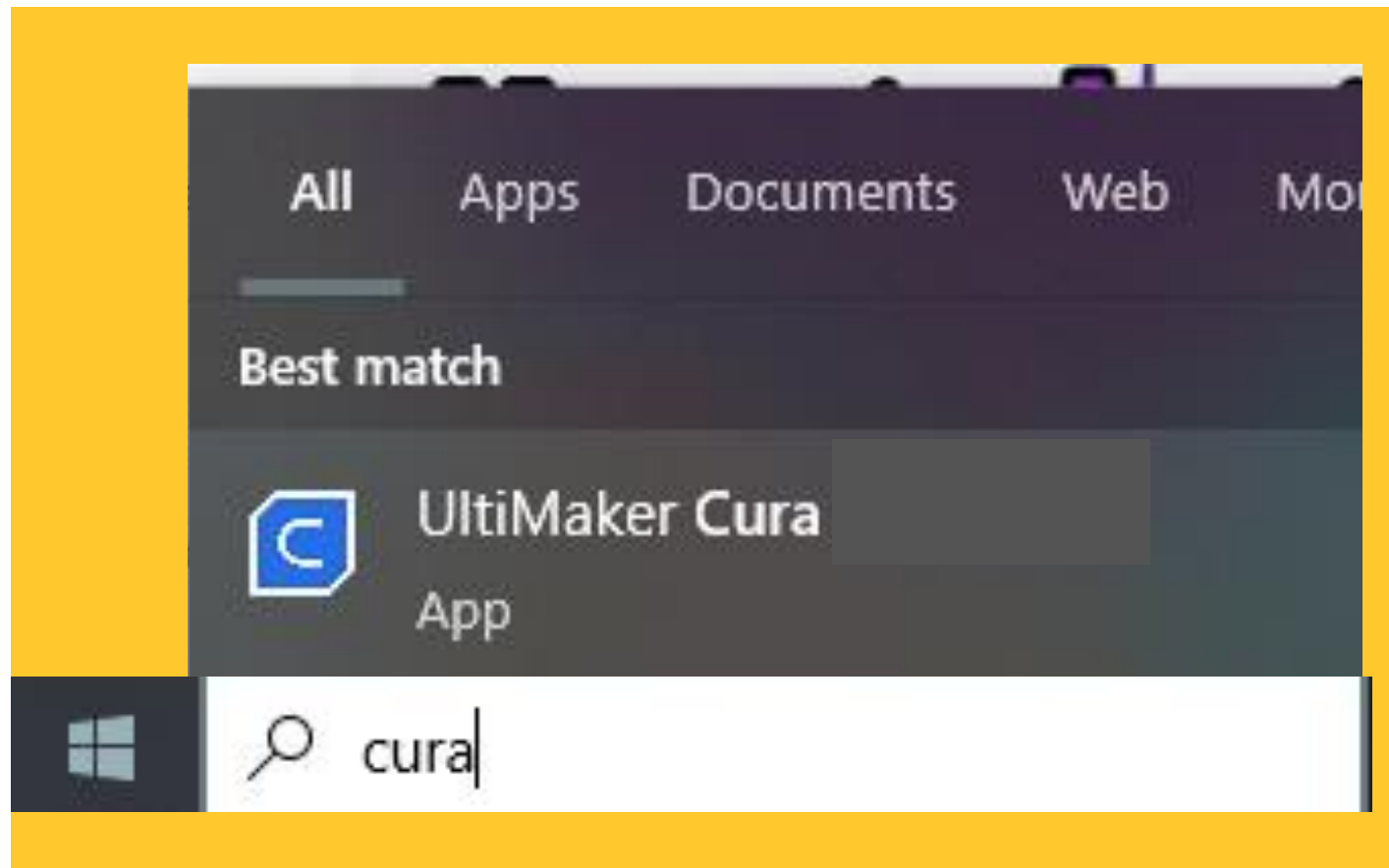
If you are printing at Newmarket Library, you will be choosing **Ultimaker 2+Connect** or **Ultimaker2+** depending on which one is available for use.

● **Selecting the Correct Print Settings**

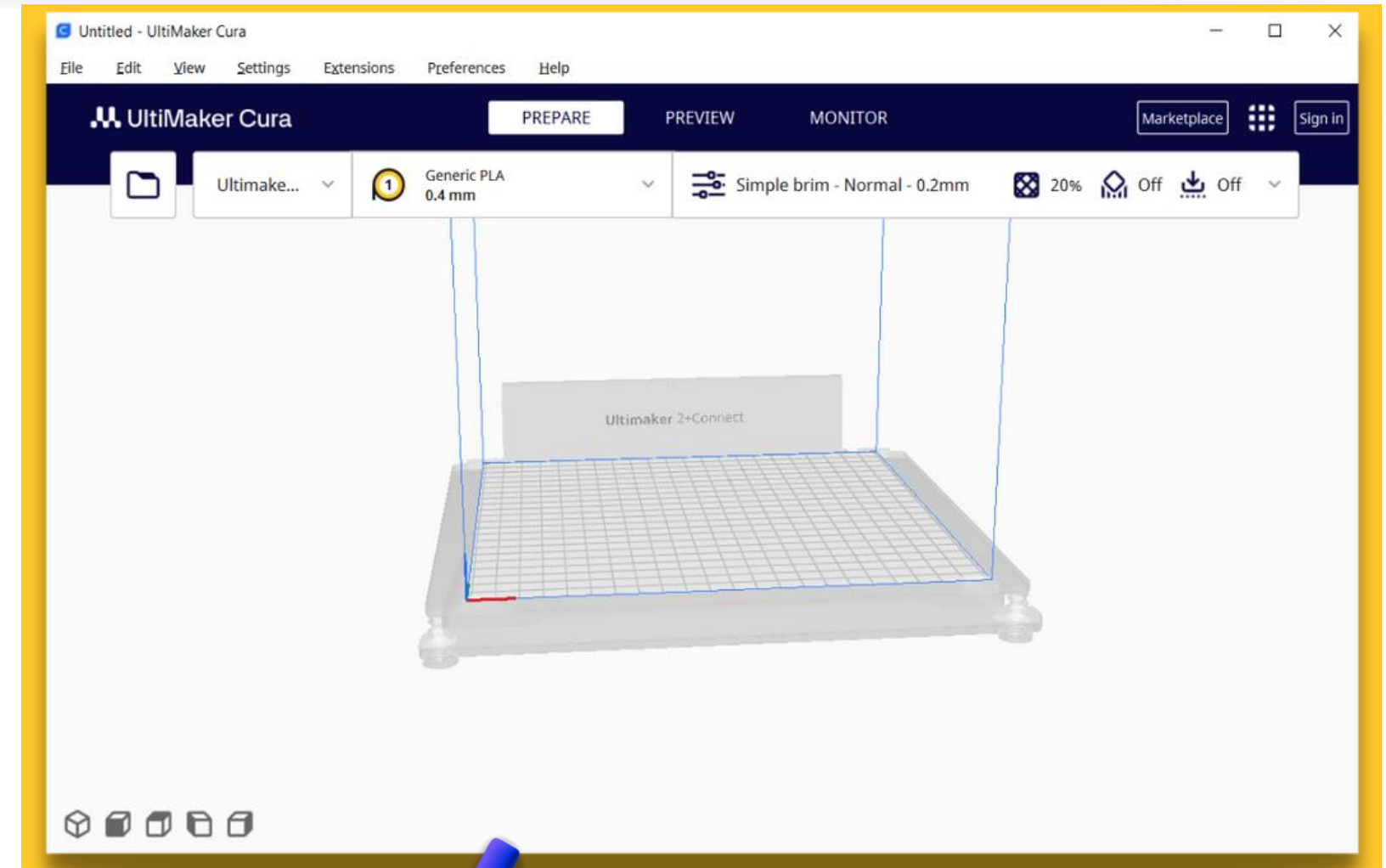
Print settings can be adjusted to your liking depending on your project. This allows you to make your print efficiently.

How to add a printer in Cura

STEP 1: Install [Ultimaker Cura](#) and open the app to add a printer.



You may use the search button on your computer to find Cura.



Printer models at the library:

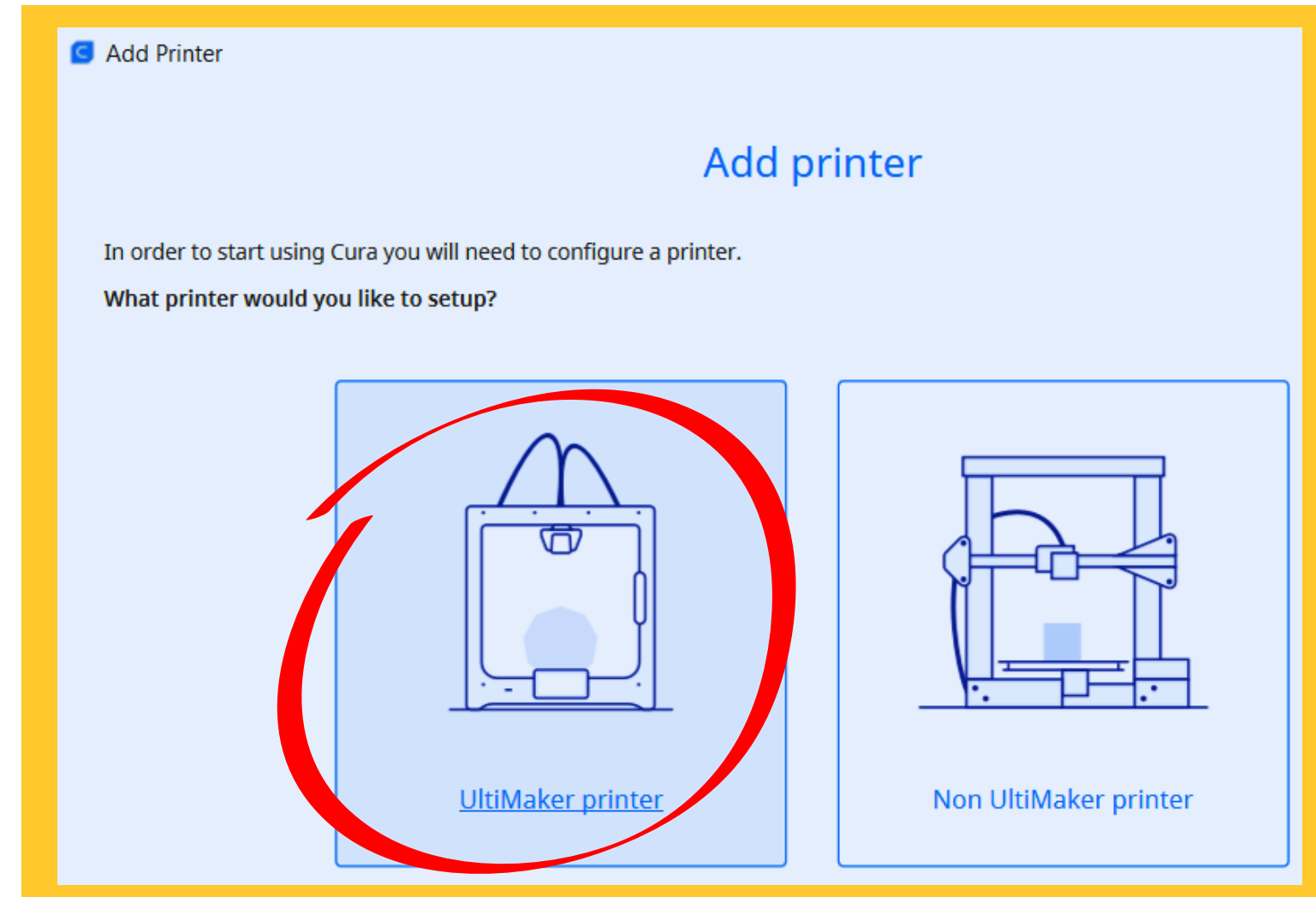
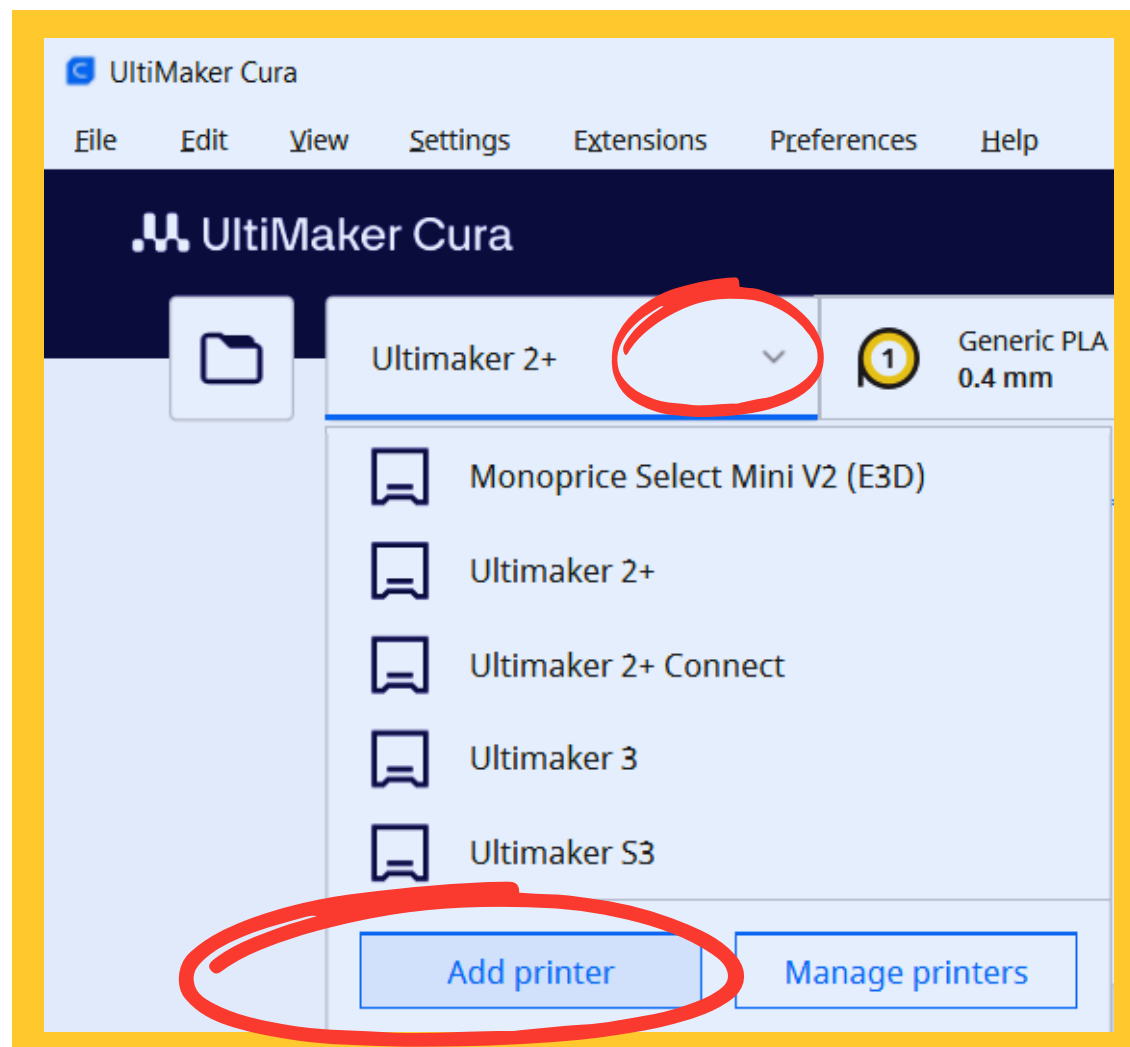
- **Ultimaker 2+Connect**



How to add a printer in Cura (contd.)

STEP 2:

Next click on the drop down menu and select **"Add Printer"** & **"Ultimaker printer"**





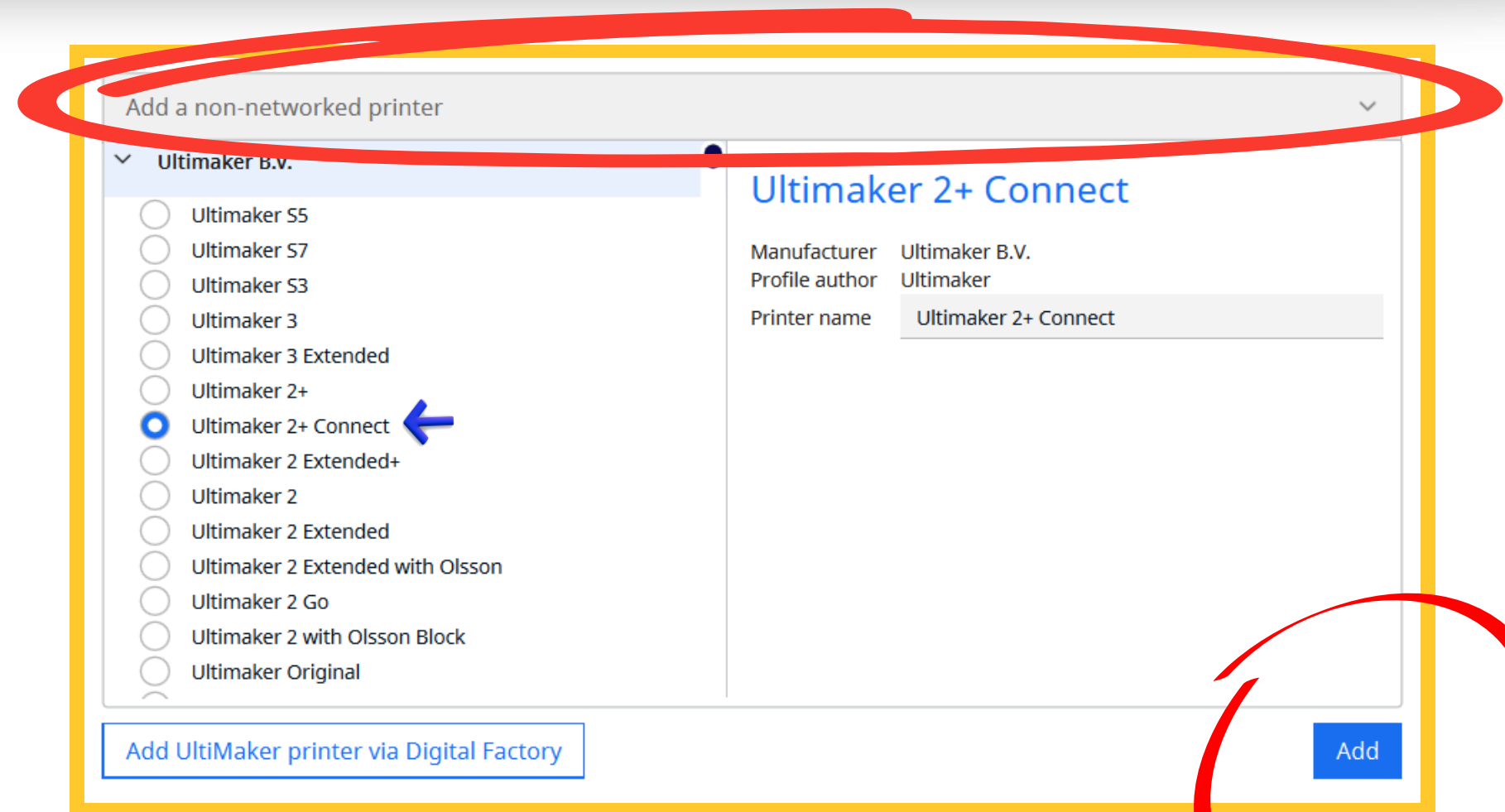
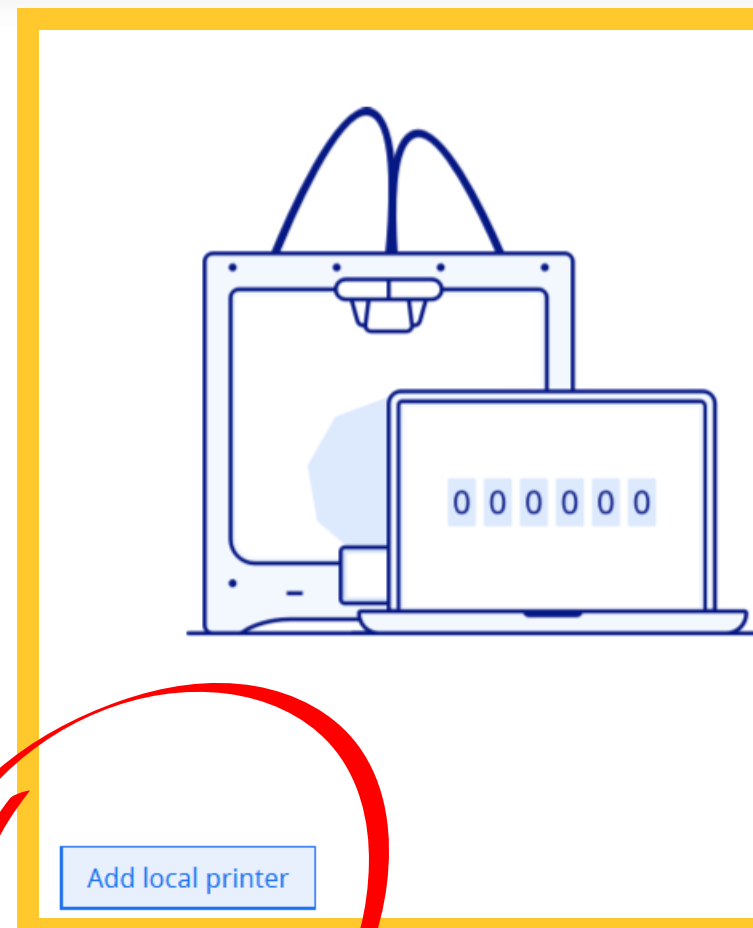
How to add a printer in Cura (contd.)

STEP 3:

Choose “Add local printer”, and click on the drop down menu for “Add non-networked printer”.

Select **Ultimaker 2+ Connect** and click on the “Add” button.

Similarly, add Ultimaker 2+.



Printer models at the library:
• **Ultimaker 2+Connect**

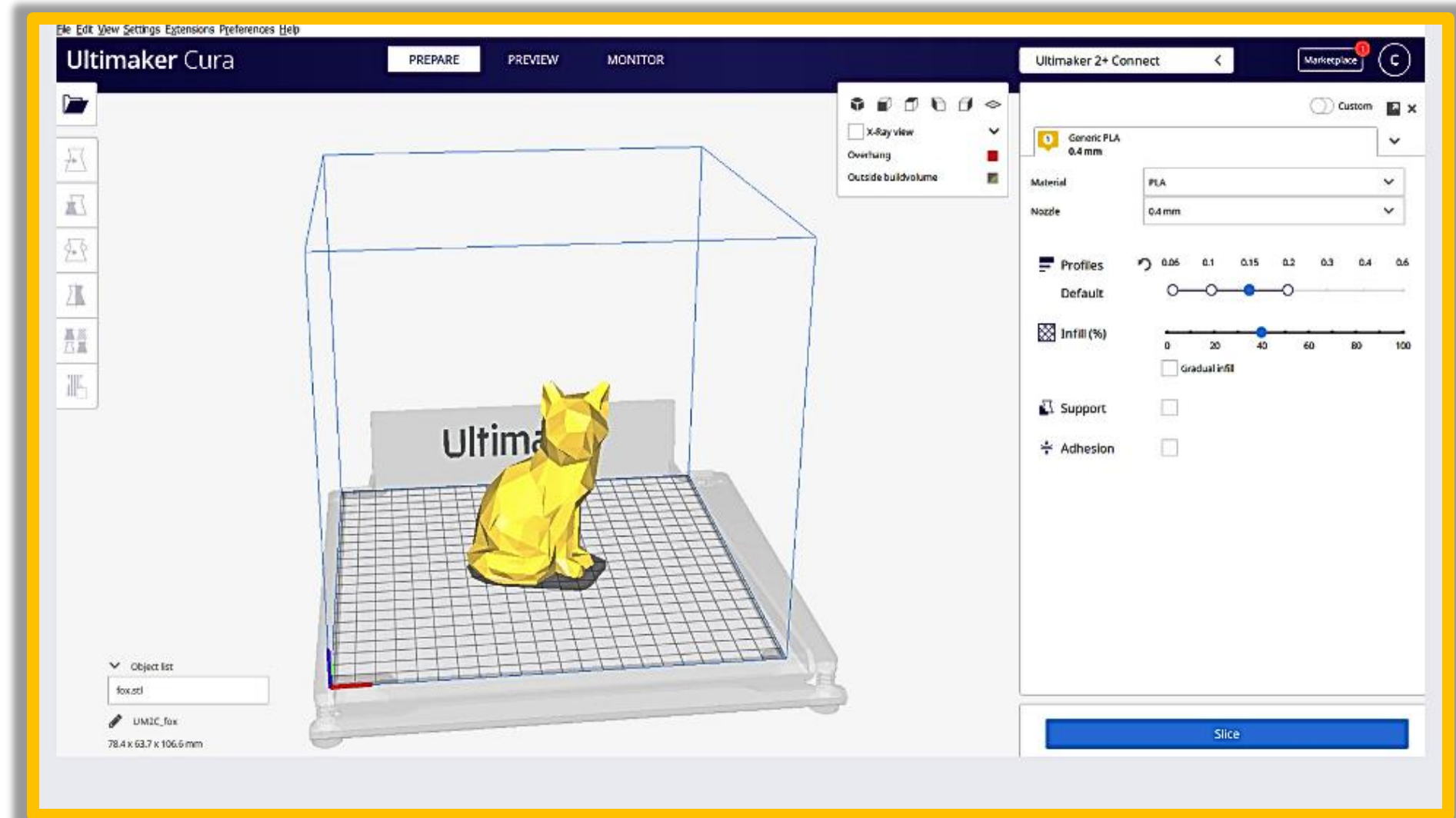


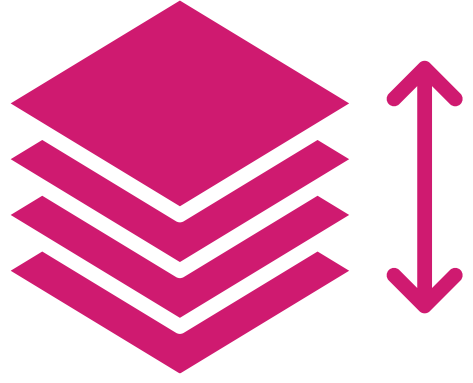
How to Slice the file

Now that the printer models are added to Cura, you can now download a **.STL** file, then open it up in Cura, select the correct printer model (UM2+Connect) and start slicing the design.

The top 4 settings to consider when slicing a design for 3D printing :

1. **Layer height**
2. **Infill**
3. **Support**
4. **Adhesion**





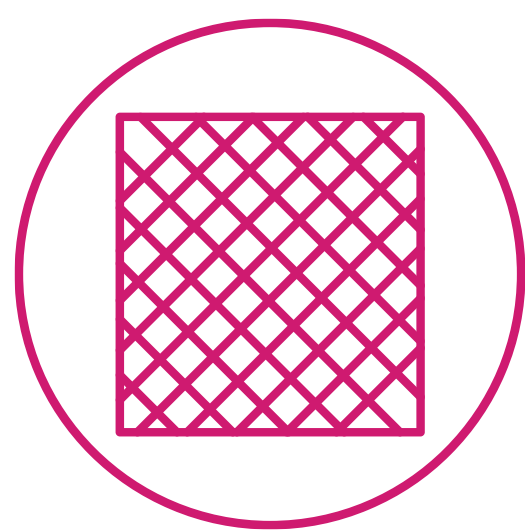
Layer Height

The thickness of each layer of deposited material is called the layer height.

Typical layer heights are 0.15 or 0.2 millimetres.



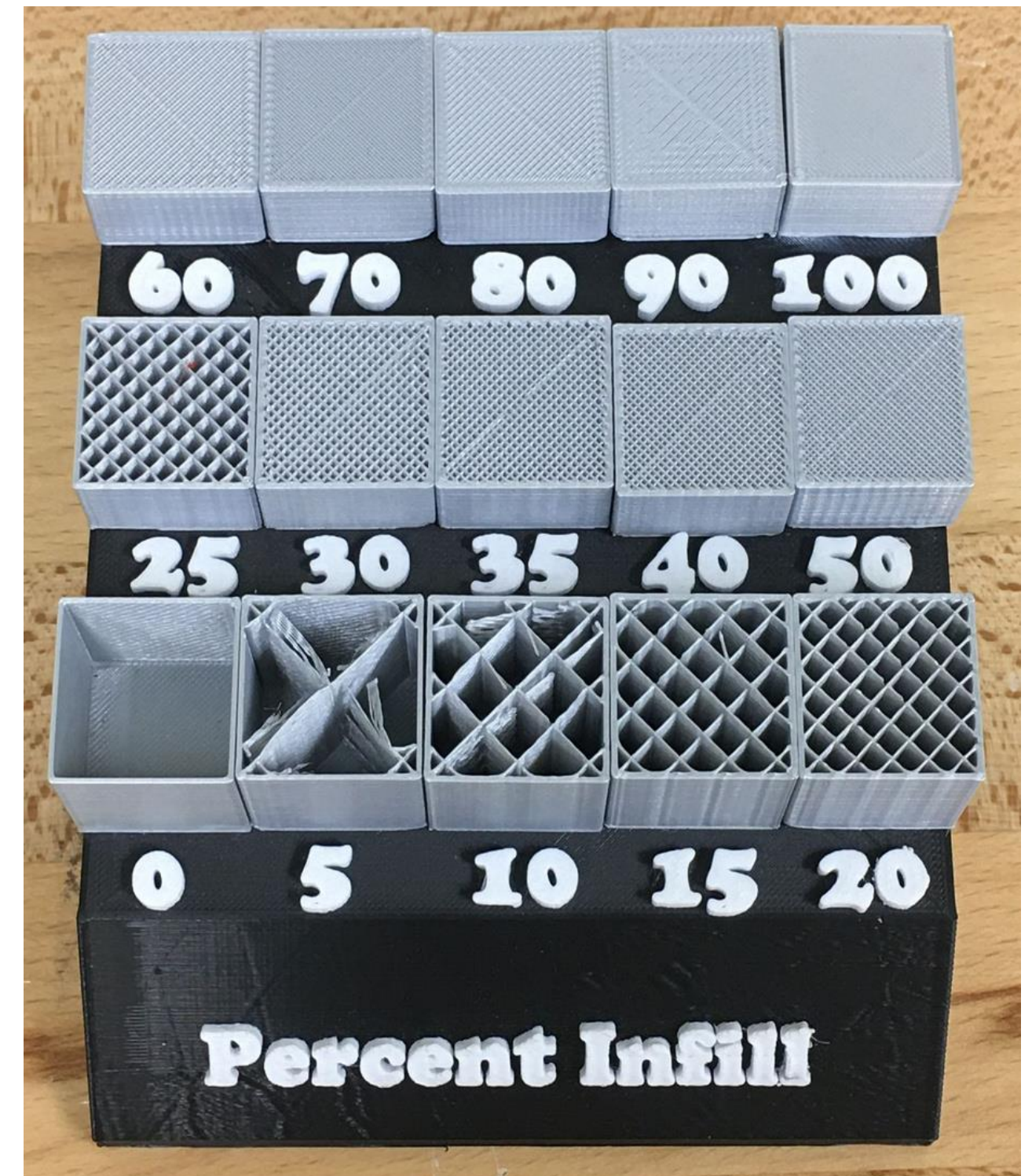
The thicker the layer, the faster it prints, but lesser the quality.



Infill

3D printed parts are typically not produced with a solid interior. Instead, the printing process fills the interior with a pattern, such as crosshatch, zigzag, grid etc.

The density of this pattern is referred to as **the infill percentage**



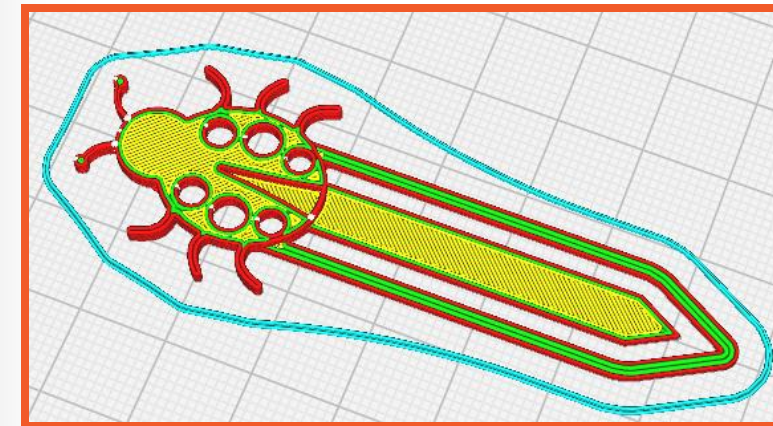
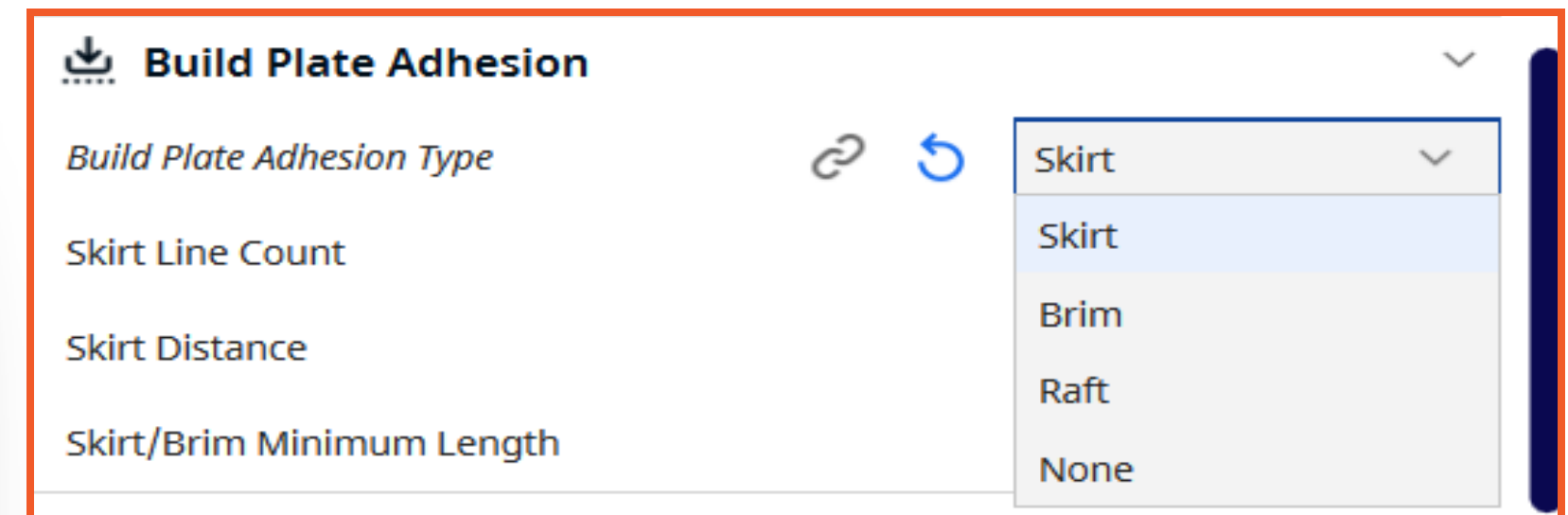
15%–20% is standard.

Bed Adhesion

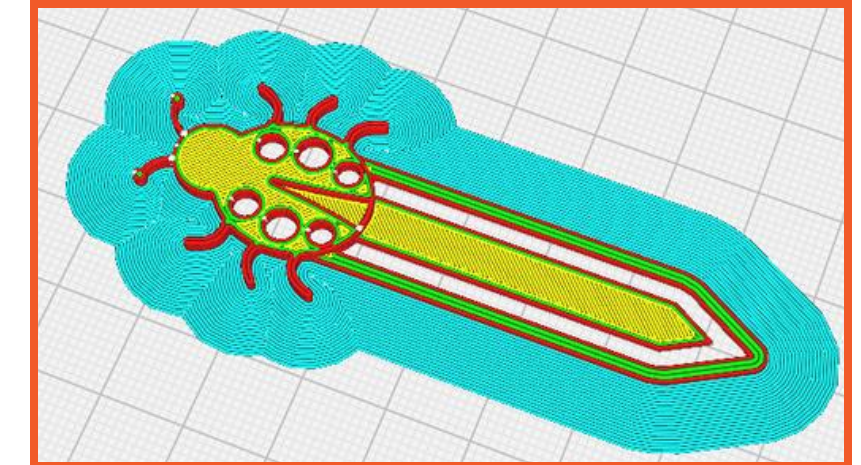
Bed adhesion is the ability of 3D print jobs to “stick” to the build plate while printing. If they don’t stay in place, the print could get curled or shift and cause the print to fail.

Turn on bed adhesion (Brim, or Raft) in Cura to create greater surface area for better sticking power. Tip: adhesion isn’t always needed.

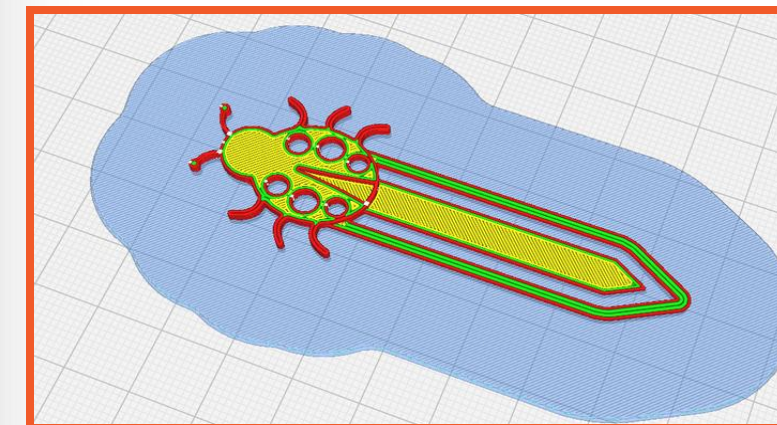
Turn on bed adhesion (Skirt) to check proper extrusion or a design flaw.



Skirt



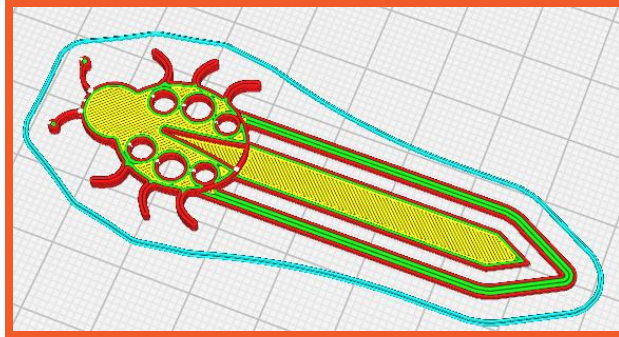
Brim



Raft

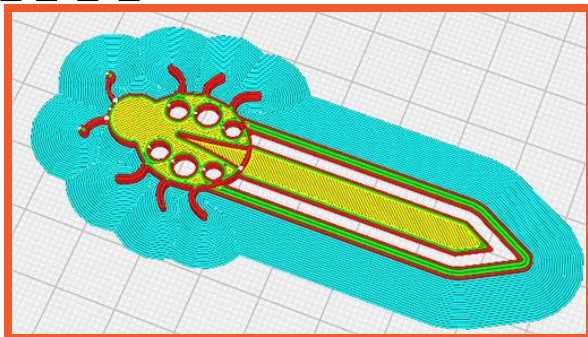
Bed Adhesion

Skirt



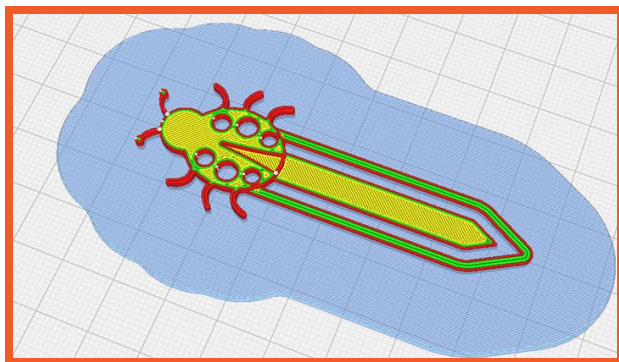
Skirts are a quick way to check if your printer is extruding properly, the bed is level, and the nozzle isn't clogged. They can also help detect a design flaw. If the skirt doesn't go around the model properly, it could mean there's a problem with the design or first layer.

Brim



A brim is a thin layer around your model that helps it stick better to the build plate and keeps the edges from lifting.

Raft



A raft is a thick, flat base printed under your model to improve adhesion, especially when the model's bottom isn't flat or has smaller surface area or doesn't stick well.

<https://all3dp.com/2/3d-printing-raft-brim-and-skirt-all-you-need-to-know/>

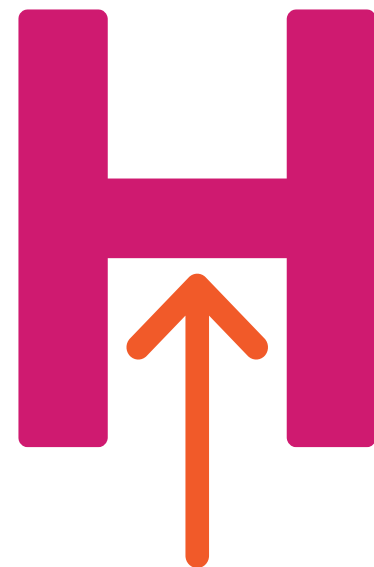
Supports

Supports are temporary structures printed to hold up overhangs or complex parts of a model. They prevent sagging or collapse during printing and are removed afterward.

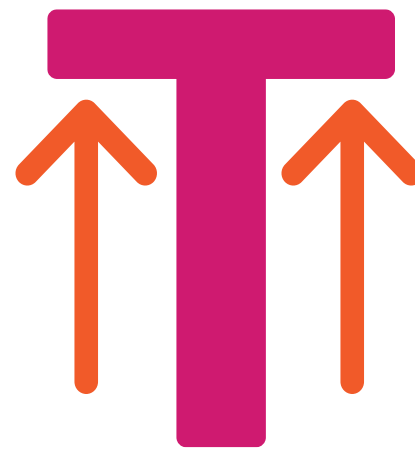
Anything **above 45 degrees** requires a support on our printers.



Overhang



Bridge



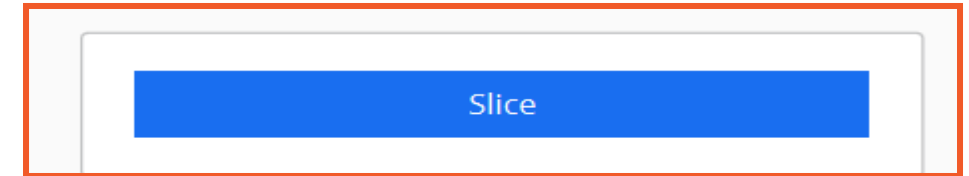
Overhang



Before and After: Model printed using supports.

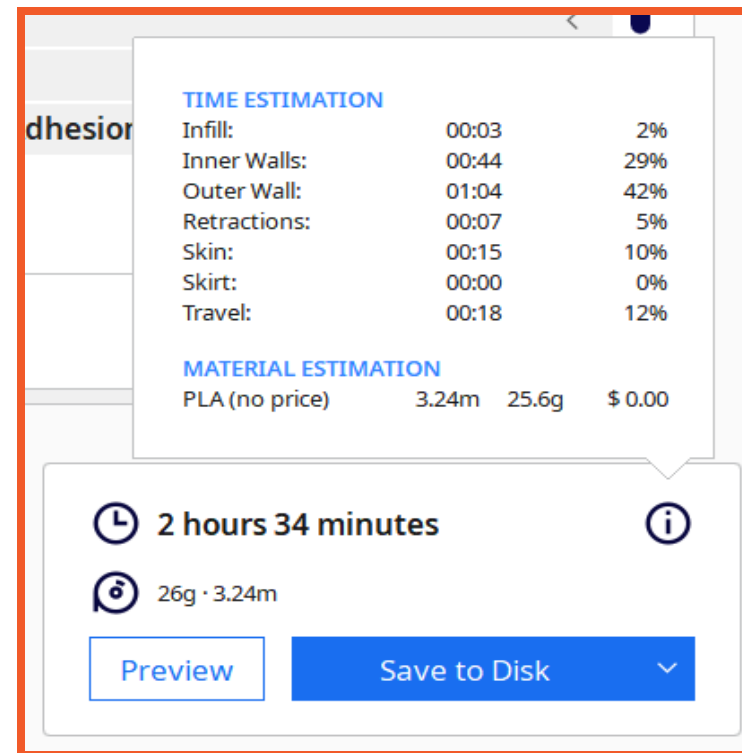
Slice and Save the file

After adjusting the layer height, infill, adhesion and support (if needed), click on **"Slice"** to create the .gcode.



After slicing, Cura will show:

- Length of time to print
 - Metres of material used
 - The ⓘ will show more information about your print.
-
- To save onto your computer: choose **"Save to Disk"**.
 - To save onto a USB stick: choose **"Save to Removable disk"**.



You can adjust Print settings to reduce the time and material used.

Take note of the metres.

Slice and Save the file

Slice

- When you slice for **Ultimaker 2+ Connect**, a **.ufp** file is generated which contains an image file together with gcode. This will enable you to see the image on the printer's touch screen. The file name will have a prefix **UM2C**

 UM2C_traincarcaboose.ufp	7/30/2025 12:19 PM	UFP File	635 KB
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- When you slice for **Ultimaker 2+**, a **.gcode** file is generated. The file name will have a prefix **UM2**

 UM2_traincarcaboose.gcode	9/19/2023 10:40 AM	GCODE File	2,821 KB
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Calculate the cost of your print

NPL charges **\$2.00 per metre** of material used. To calculate the total cost of your print, you should multiply the number of metres by the cost per metre. See the [Maker Hub page](#) for a current cost per metre.

For example:

You sliced a file that will use **2.44 metre**. If the filament costs **\$2.00 /metre**, the cost of your print is calculated as **$2.44 \times \$2.00 = \4.88**

Using our 3D printers

3D Printer Safety

It is important to be safe when using the 3D printers.

Here are some areas of risk on the printers:

- **Burn risk** – nozzle gets hot (210°C when in use)
- **Burn risk** – build plate gets hot (60°C when in use)
- **Pinch risk** – nozzle and build plate are moving parts that create pinch-points when in operation



Safety rules to follow when operating the 3D printer

Now that we know the areas of risk, how do we stay safe while 3D printing?

1. Always assume the nozzle is hot and don't touch it with your hands.
2. Only reach into the printer through the front.
3. Never reach into the printer when it is in motion.
4. Never reach into the printer through the top.



Failure is part of learning

- Failure is a welcome part of the learning process.
- It is OK to fail.
- Don't be afraid :)
- If your print fails, you can try again for free.
- If you don't know why it failed, then ask us! We can help.



Bring the sliced file in an external drive

The USB or SD card must remain plugged into the printer for the entire print job. The printer doesn't have internal storage, so removing the drive will interrupt the print.

1. Slice your model in Cura.
2. Bring the sliced file and the original .STL to the library, in case you need to adjust any print settings.
3. Transfer the sliced file to a storage device that is compatible with the printer you will use (**USB stick for UM2+Connect** and **SD card for UM2+**).

Bring the sliced file in an external drive

4. Use the printer menu to navigate through the options:
 - a) Change material (to put a new colour in)
 - b) Print (to select your file)
 - c) Pause and Abort (only available while printing)
5. Carefully watch the screen for any instructions.

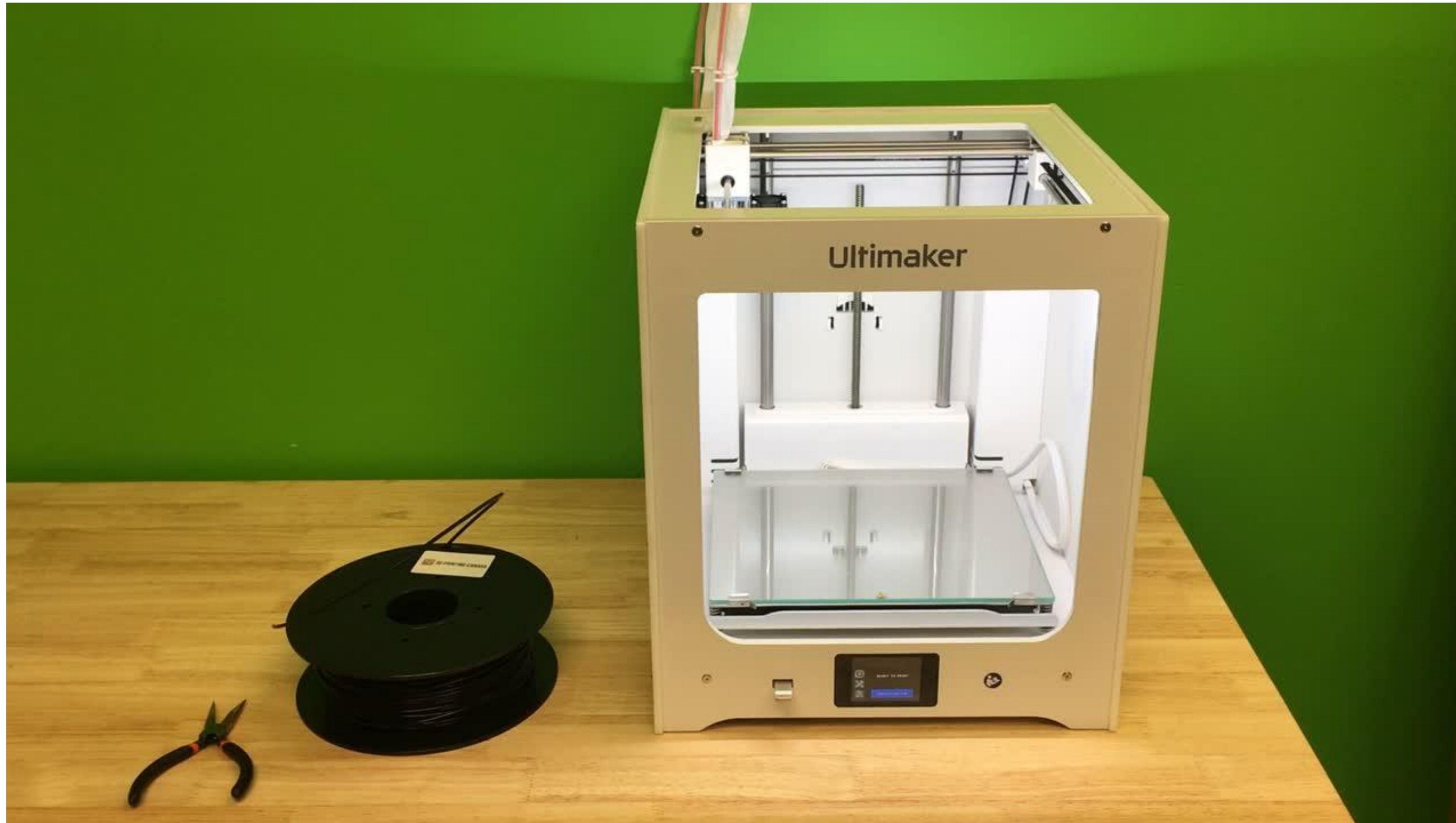
How to load new colour into the printer

Loading/Unloading filament: Arrange the steps below in the correct order for loading filament onto Ultimaker 2+Connect printer. *

- 1 **Turn on printer:** Use the switch at the back to turn the printer on > select **Spool** symbol > then choose **Change Material**.
- 2 **Confirm filament type :** Choose the filament type that's being loaded (**only PLA is allowed**)
- 3 **🔥 Nozzle heating:** Printer will begin heating the nozzle to prepare the filament for Unloading. Wait until heating is complete, then follow the on-screen instructions carefully to unload the filament.
- 4 **Filament change:** When prompted, unload the old filament and insert the new one. Guide the filament through the feeder and push it in until it reaches the nozzle and feels snug.
- 5 **Confirm material loaded:** Select **Material loaded**, then **pause** and read the next on-screen step carefully. Do not proceed until the printer extrudes the new filament and the colour is right,
- 6 **Confirm material extrusion:** Wait until the printer extrudes the correct filament colour, then select **"Material is extruding"**.
- 7 **Return to main menu:** Finally, return to the main menu.



How to load new colour into the printer



Required watching

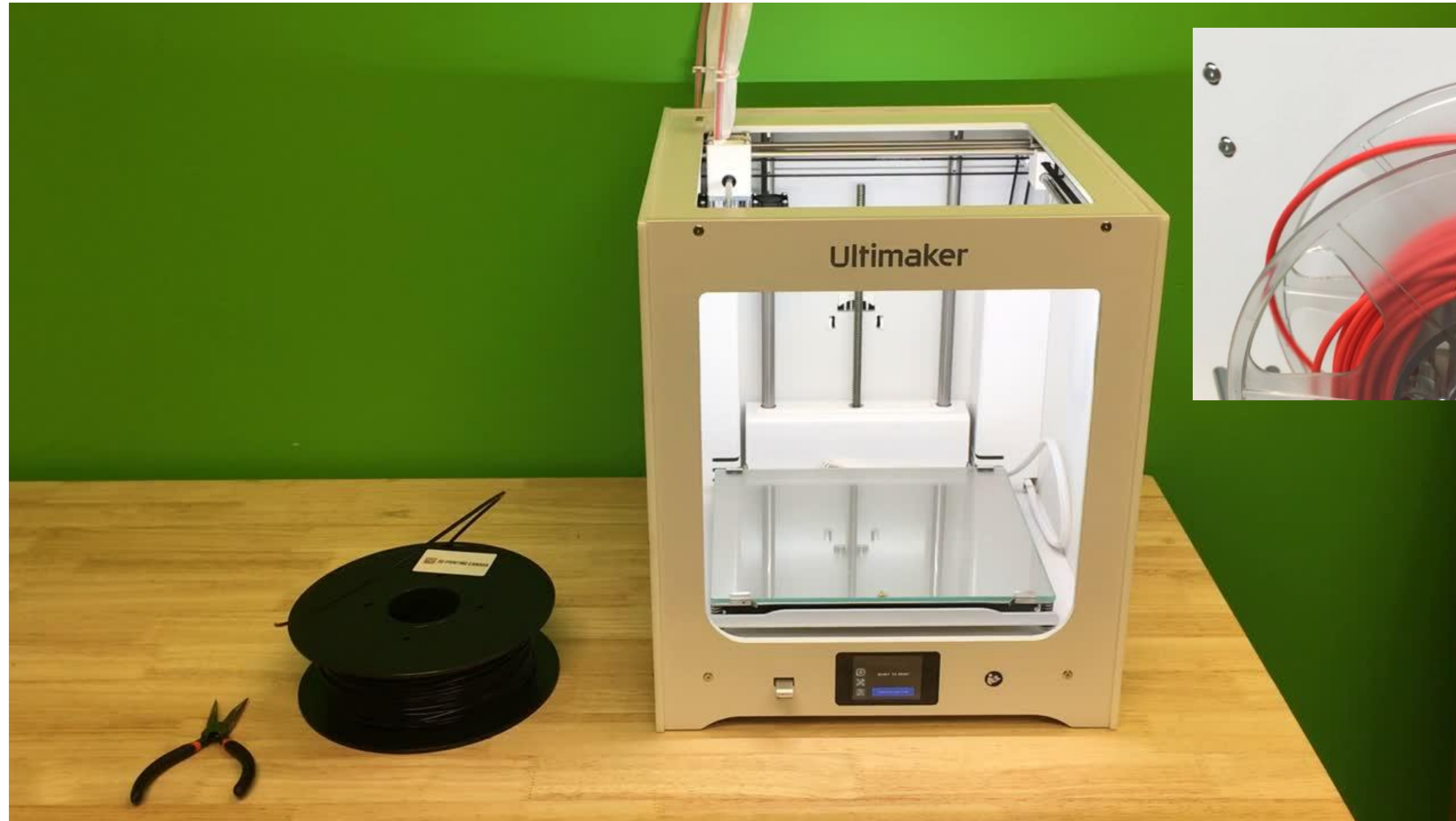
How to store the filament properly

When not in use, **secure** the loose end of the filament by inserting it into one of the holes on the spool.

Then, **place the spool** in a zip-lock bag to protect it from moisture, and **store** it in the Maker Hub cabinet.

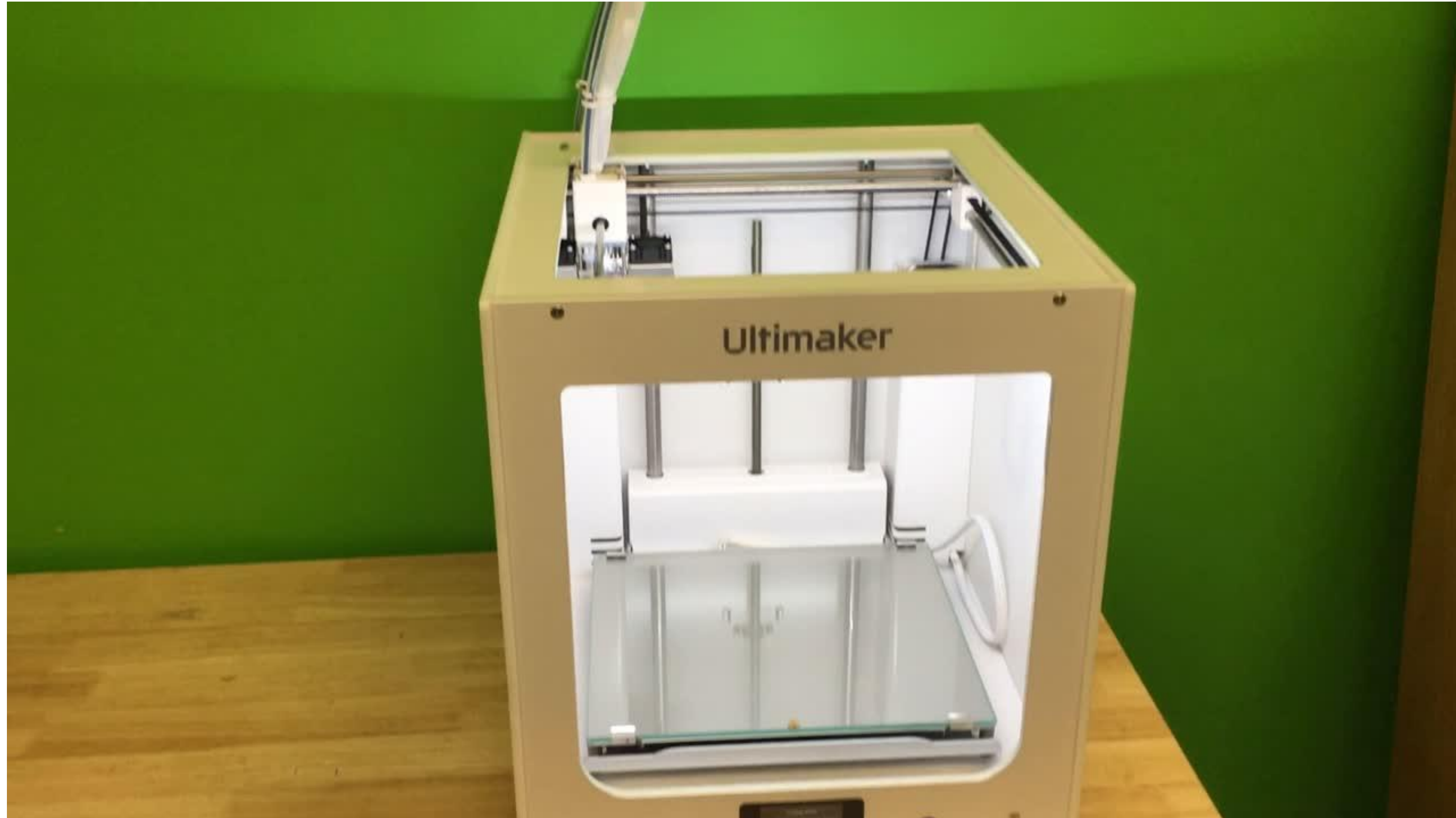


How to store the filament properly



Required watching

How to start and make a 3D print



Required watching

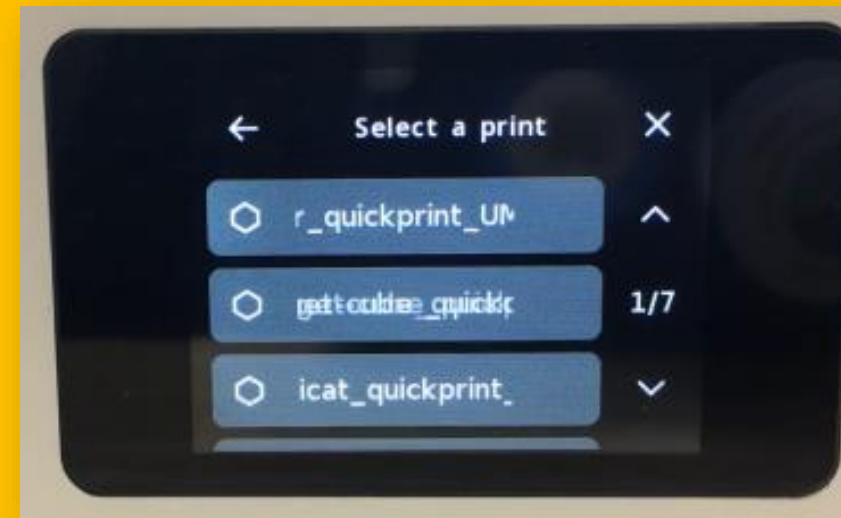
How to start and make a 3D print

Step 1



Press **"Select from USB"**

Step 2



Select the correct file

Step 3



Press **"Print"**

Step 4

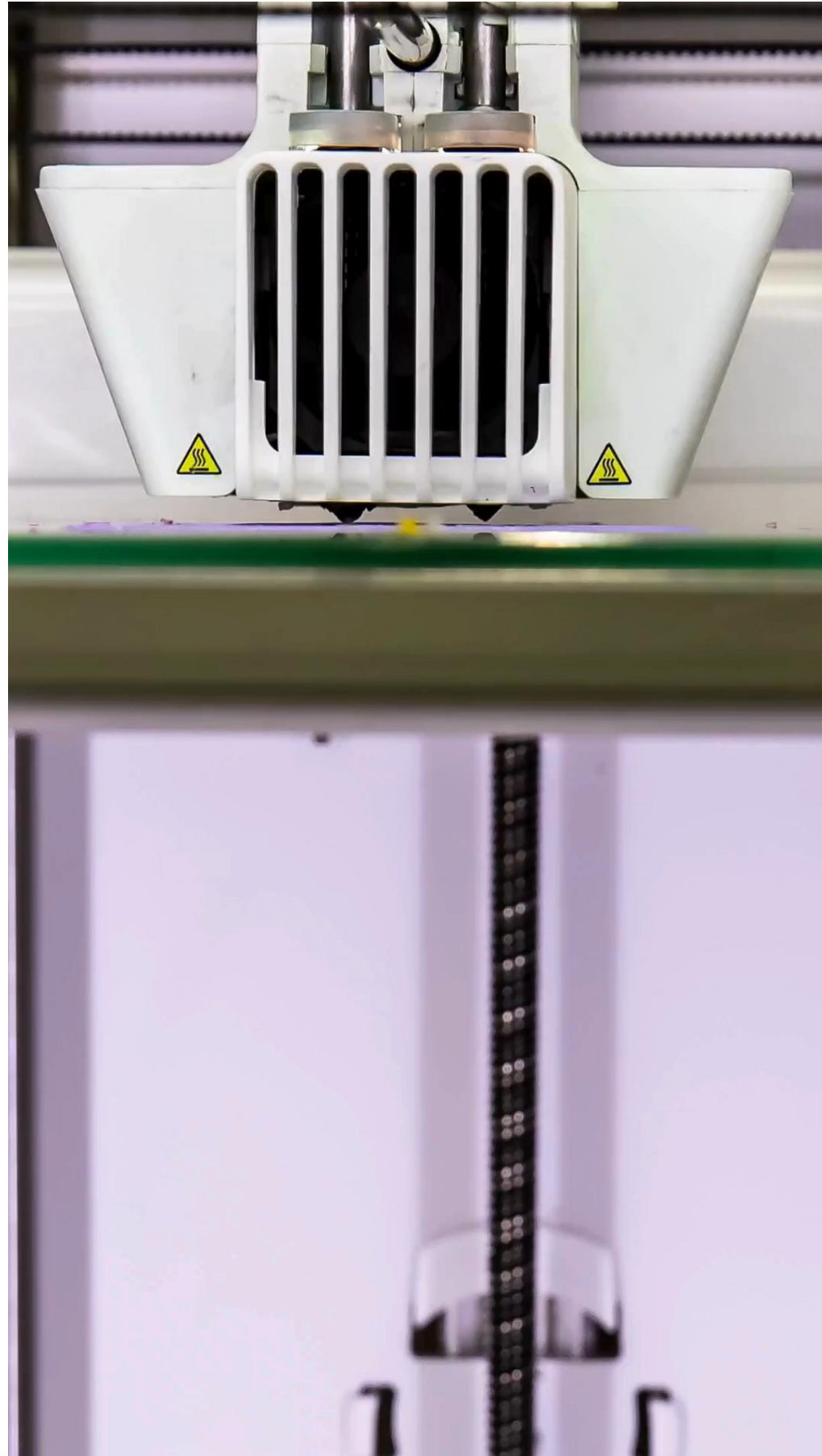
Stay with the print
for the first 20
minutes of active
printing

Step 5



Press **"Print removed"**

When to remove the 3D print



Once you see the "Print finished" message on the screen, it is ready to be taken out. Use a spatula to remove the print and never touch the glass-built plate with your fingers. The cooler the build plate the easier it is to remove.

Step 5



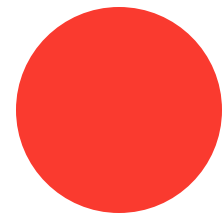
Press "Print removed"

Training Checklist



1

**Read through & watch
this slideshow**



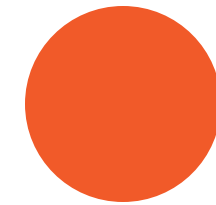
2

**Take the quiz!
(Re-take as needed)**



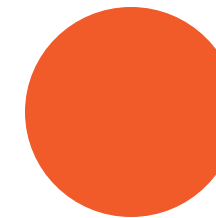
3

**Sign the online
Maker hub agreement**



4

Book A demo



5

**Book an appointment to
use the 3d printer**

Part 2

Quiz

Certification Quiz

[Click here to take the 3D Printer Certification Quiz](#) to test your knowledge.

After you submit your answers, click “View Accuracy” to review your answers. (If you made any mistakes, you can edit your response and try new answers.)

Your quiz results will be sent to staff who will mark this on your account.



Training Checklist



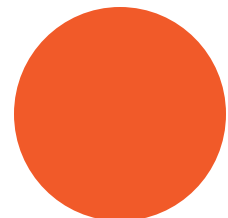
1

**Read through & watch
this slideshow**



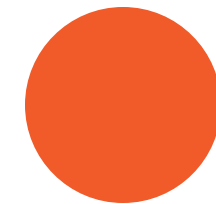
2

**Take the quiz!
(Re-take as needed)**



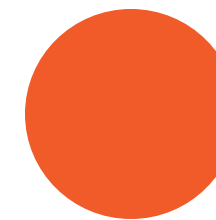
3

**Sign the online
Maker hub agreement**



4

Book A demo



5

**Book an appointment to
use the 3d printer**

Part 3

Maker Hub Agreement

Maker Hub Agreement form

Please complete this form to confirm that you know how to be safe in the Maker Hub and will report any issues to staff.

[NPL Maker Hub Agreement form](#)

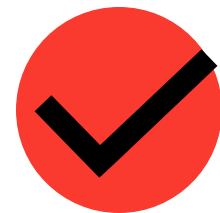
This form will be sent to staff who will mark it on your account.

Training Checklist



1

**Read through & watch
this slideshow**



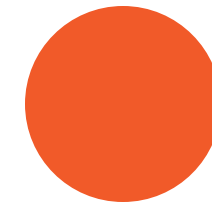
2

**Take the quiz!
(Re-take as needed)**



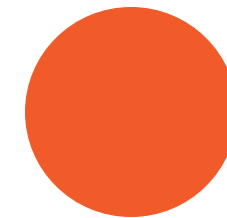
3

**Sign the online
Maker hub agreement**



4

Book A demo



5

**Book an appointment to
use the 3d printer**

Part 4

Book a Demo

Visit the library

Book a time to do a demo print

- After successfully completing the Certification Quiz and submitting the Maker Hub Agreement Form, the last step is to show us what you know!
- Staff will observe and answer any questions. It is OK to ask for help!
If you make a mistake during this process, it's okay to try again!

How to show us your 3D printer skills:

1. Book an appointment to come in and do a demo print(use form on Maker Hub page).
2. Unload/ load a new filament spool into UM2+Connect printer by choosing the spool icon and following the onscreen instructions.
3. Find the **Certification** folder and choose one of the quickprints from the list and start the print.
4. Once the printer cools down and displays the message "**Print finished. Remove print**", remove the print from the printer.

How to show us your 3D printer skills:

5. Next, unload the filament by choosing the spool icon on the screen and following the onscreen instructions.
6. Tuck the end of the reel into one of the holes on the spool to prevent filaments from getting tangled.
7. Store the filament in a Ziplock bag and place it inside the cabinet.

Staff will observe and answer any questions. It is OK to ask for help and try again if you make a mistake!

How to show us your 3D printer skills:

****** If you want to print your own project during the visit to get certified, please submit another booking form or add as a note to the demo booking request, so we can arrange for extra time to use the printer.

Staff will verify your quiz and Maker Hub Agreement and then update your library account as a certified user to use the 3D printers.

Part 5

How to use our 3D printer once certified

Using the printer to print your own projects

Now that you are certified, you may begin to book a time to use the 3D printers at Newmarket Library.

- Please use the Booking form on our [Maker Hub page](#).
- You may also send us an email to makerhub@newmarketpl.ca or Call us at 905-953-5110 extn 4735.
- Please include the time and filament metres needed for your project when you make the request.

Useful links and resources

Thank you for your interest in learning about 3D printing and how to use the printers at the library. Here are some links for your reference.

- Email us with any questions: **makerhub@newmarketpl.ca**
- [NPL Maker Hub page](#) ([Book an appointment in the Maker Hub](#))
- [3D Printer Certification Quiz](#)
- [NPL Maker Hub Agreement](#)
- Useful links to outside sites:
 - CAD design software: [TinkerCAD](#), [Blender](#), [onshape](#) , [AutoCAD](#)
 - Find free designs to download and print: [Thingiverse](#), [Cults3D](#), [PrusaPrinters](#), [Printables](#), [crealitycloudcollection](#)
 - [Smithsonian Institute](#) has digitized parts of their collection.
 - [Scan the World open Source Museum](#) is full of 3D scans and renders of artifacts

Useful links and resources

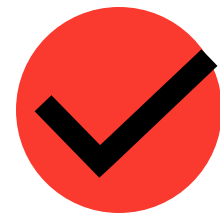
- Useful links to outside sites:
 - 3D models of replacement parts for toys and games: [Toy Rescue](#)
 - 3D modelling sites:
 - Create your own custom cookie cutter: [Cookiecad](#)
 - Turn any photograph or image into lithophane: [Lithophane maker](#) , [3dprocks](#)
 - Tips and considerations while printing with PLA: [Guide for printing with PLA – Raise3D](#)

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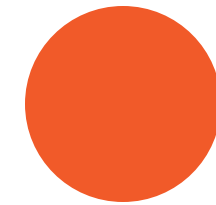
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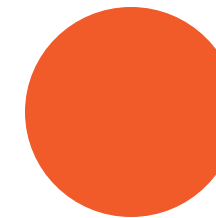
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Well done! You've completed the slides!
Once you take the quiz and submit the Maker Hub Agreement- it's time to show off what you've learned.



Training Checklist

- | | | | |
|---------------------------------------|---------------------------------------|----------------------------|---|
| ☒ 1 | Read through & watch this slideshow | ☐ 4 | Book A demo |
| ☒ 2 | Take the quiz!
(Re-take as needed) | ☐ 5 | Book an appointment to use the 3d printer |
| ☒ 3 | Sign the online Maker hub agreement | | |

Thank you!

