Getting Started with 3D Printing

With Tom Allston

Getting Started with 3D Printing

- What is 3D printing and what can we do with it?
- EE's printer: Creality Ender 3
- Safety!!!
- The printing workflow
  - 3D model formats
  - Slicing your model
  - Printing your model
- Bed Levelling

What is 3D Printing?

- 3D printers are tools which turn raw material into 3 dimensional objects
- Many different types of printers
- Many different types of materials
- Essentially, 3D printers bring your ideas into reality

How does it work?

- Most printers heat plastic until it is molten by pushing it through a hot nozzle
  - Similar to how a hot glue gun works!
- The nozzle is on a computer controlled mechanism which places it in just the right locations
- Hot material is laid onto a build platform layer after layer
- The material quickly cools and hardens into a single object

What kinds of things can we print?

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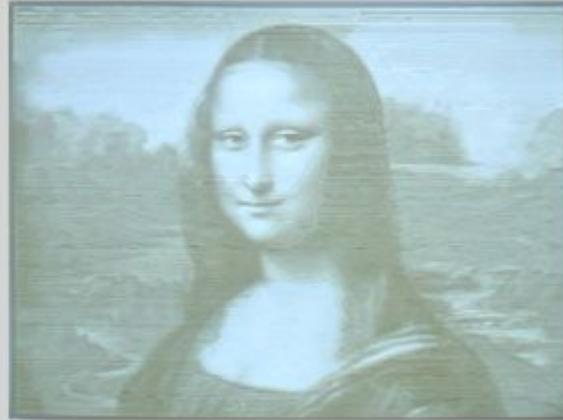
What kinds of things can we print?

Time lapse 8x

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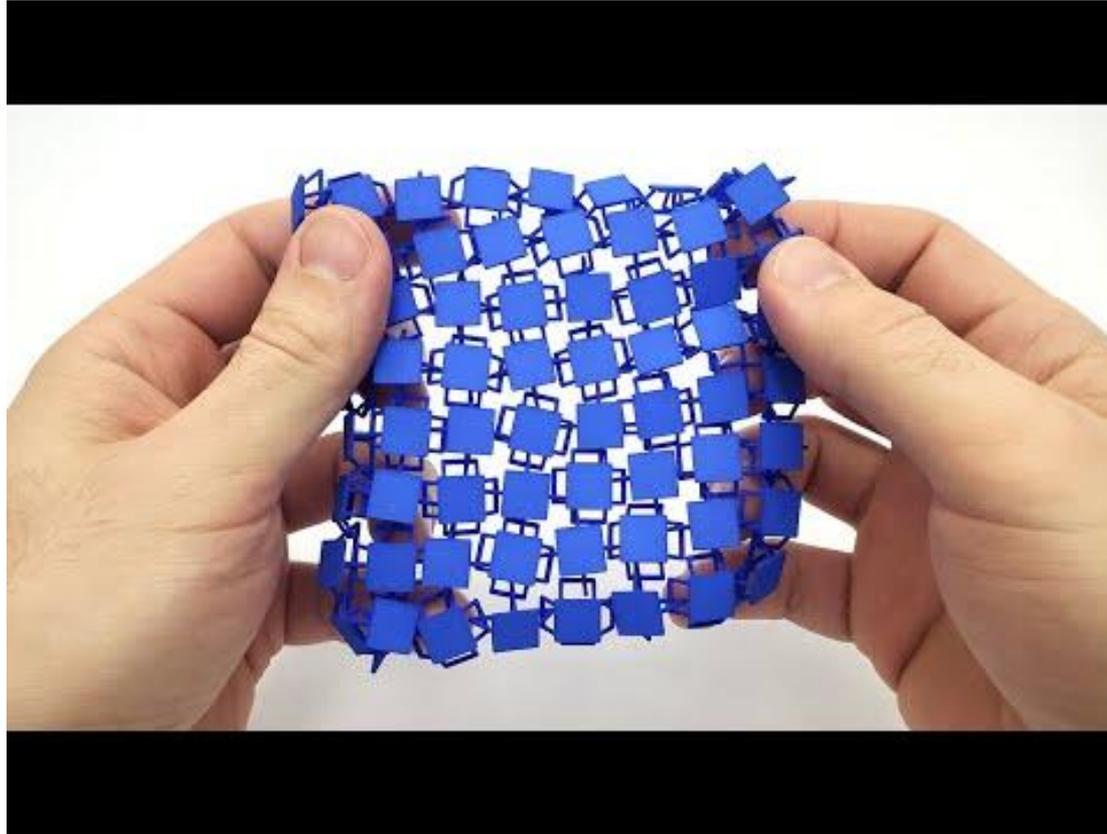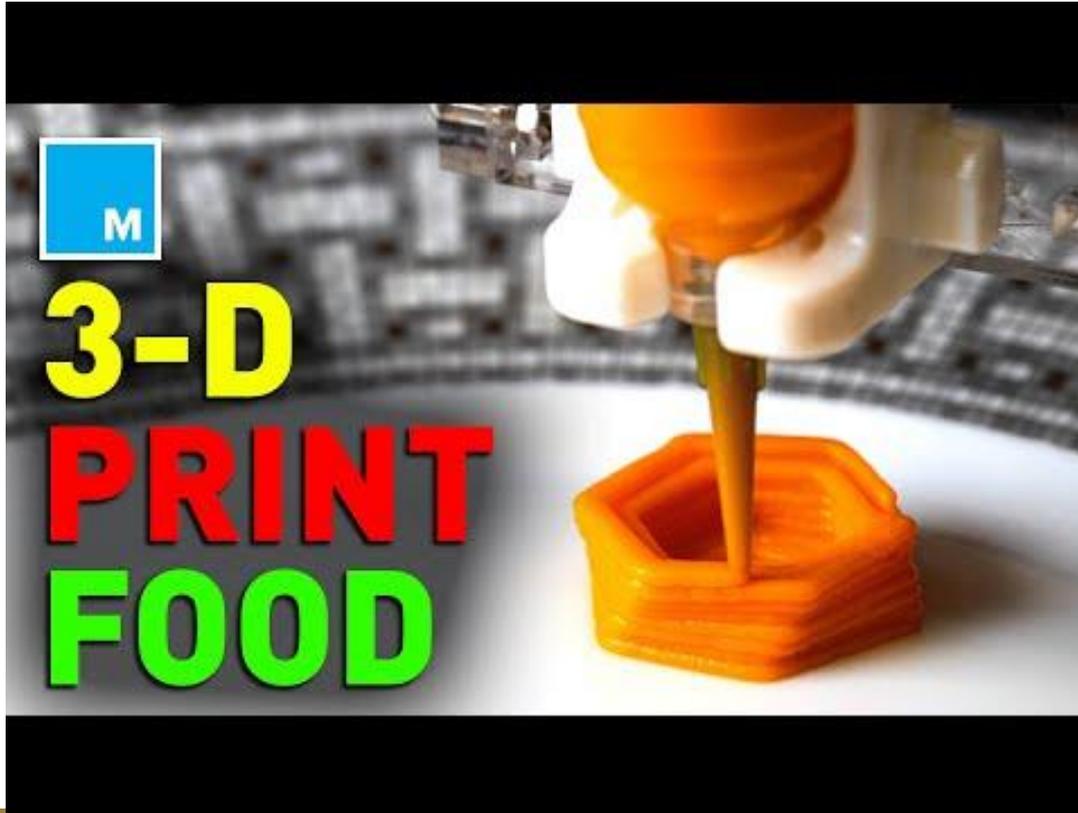# What kinds of things can we print?
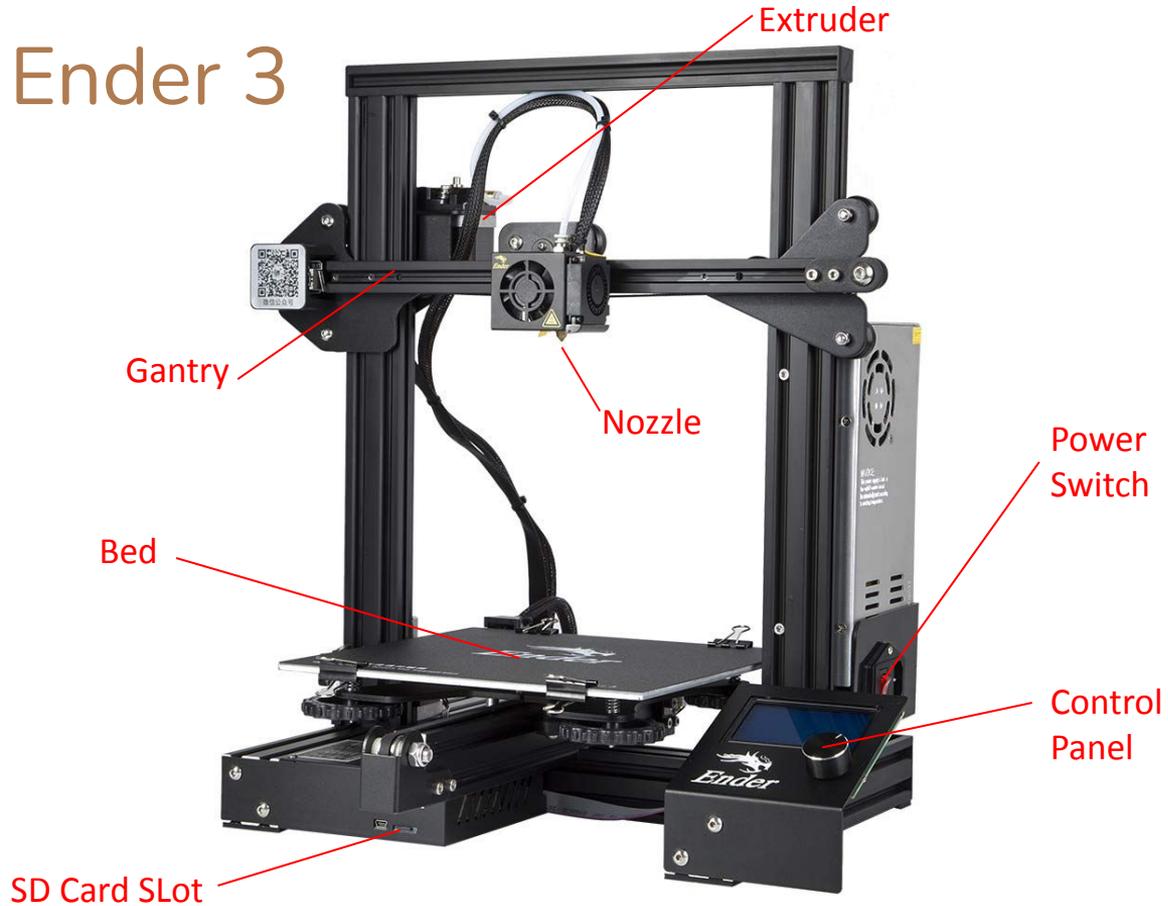
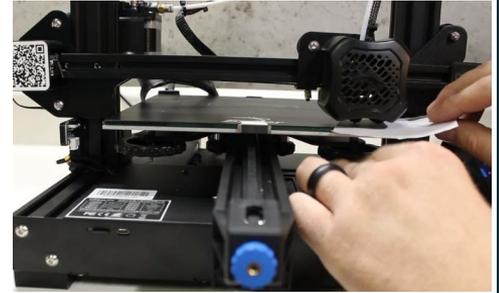# What kinds of things can we print?

Creality Ender 3

- EE's in house 3D printer
- 220 x 220 x 250 mm build volume
- Easily prints PLA and PETG
    - Other materials are possible too
- Huge online community to help with troubleshooting
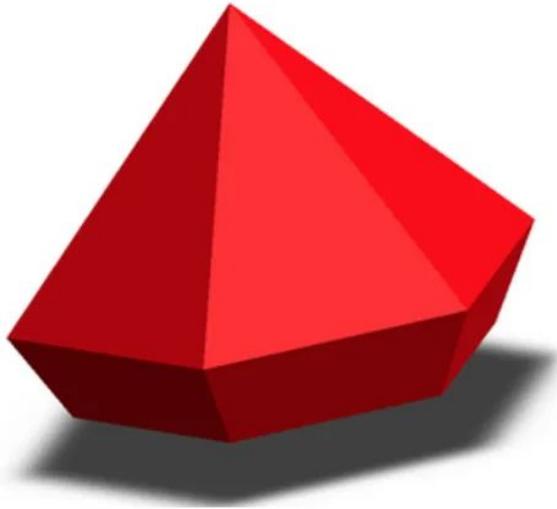
Creality Ender 3

Extruder

Gantry

Nozzle

Bed

SD Card SLot

Power Switch

Control Panel

Safety!!!

- In general some part of any 3D printer will be dangerous
- For the ender 3:
  - Nozzle reaches over 200 degrees
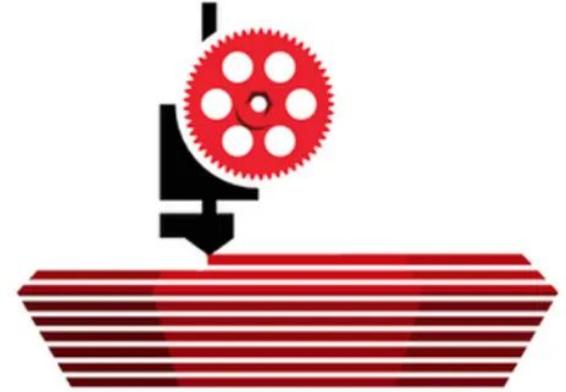 - Bed reaches over 70 degrees
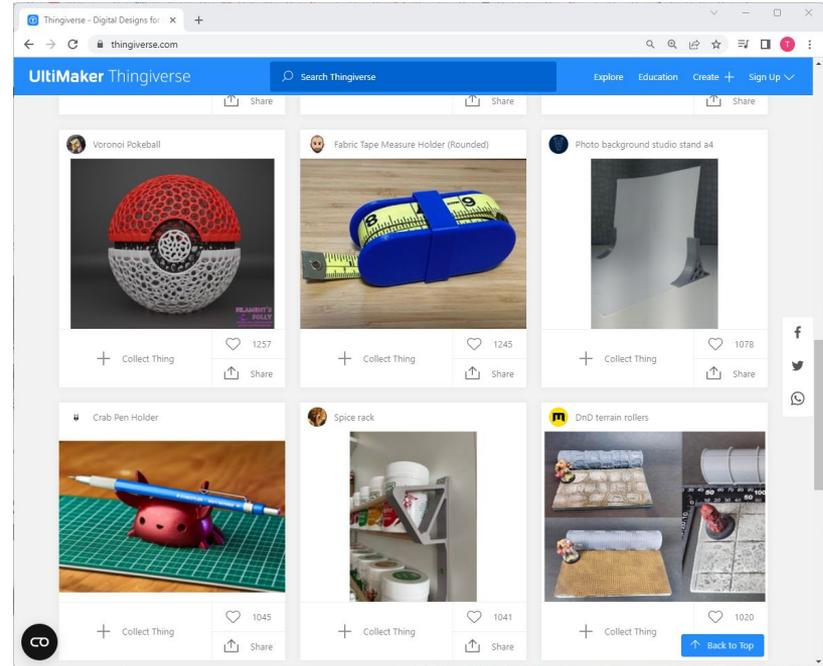 - Pinch points

3D Printing Workflow

STL → **Slicer** → **3D Printer**
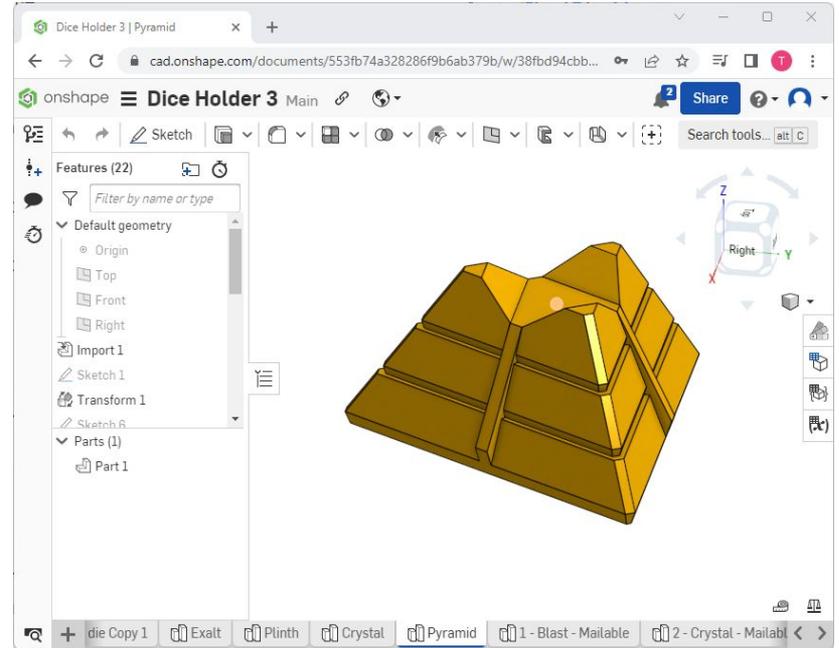
3D Models

- 3D model communities:
  - Thingiverse
  - Printables
  - NASA
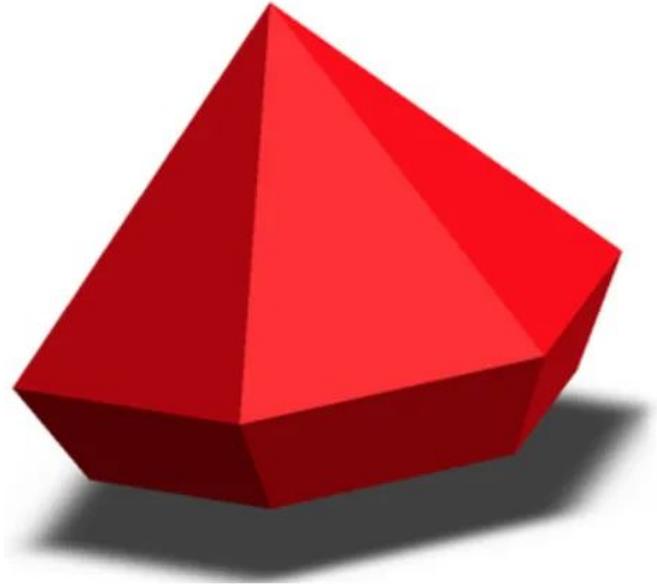 - Smithsonian
  - Many more

3D Models

- 3D modelling software:
  - OnShape
  - Fusion 360
  - SketchUp
  - Blender
  - Many More

3D Models

- .STL format is the most common
- .OBJ less common
- Many programs will convert other files to these formats
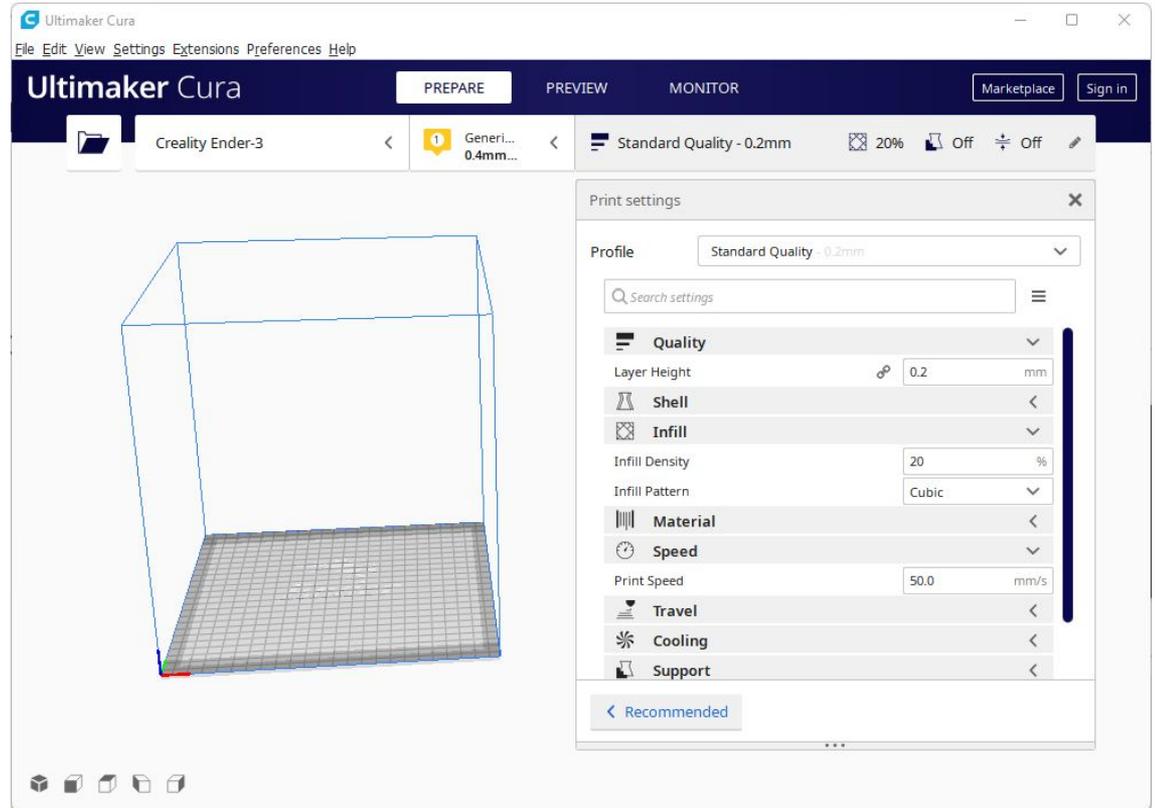
Slicing

- Turning 3D models into printable files
- Model is split into horizontal layers or "slices"
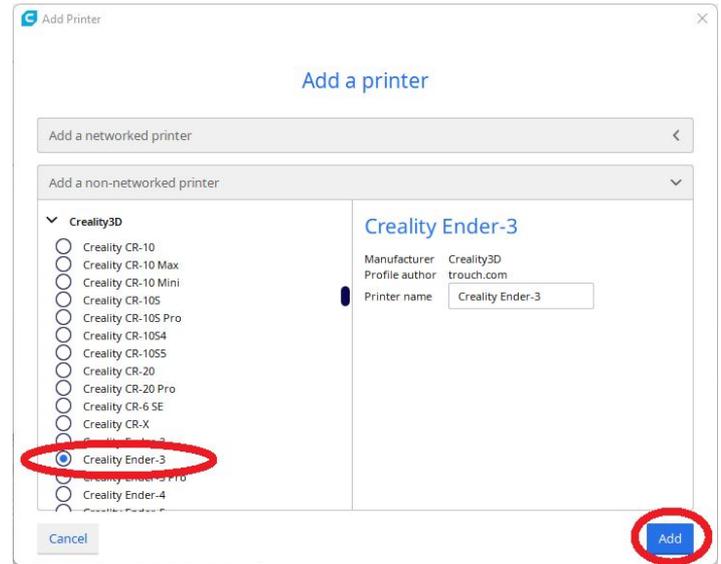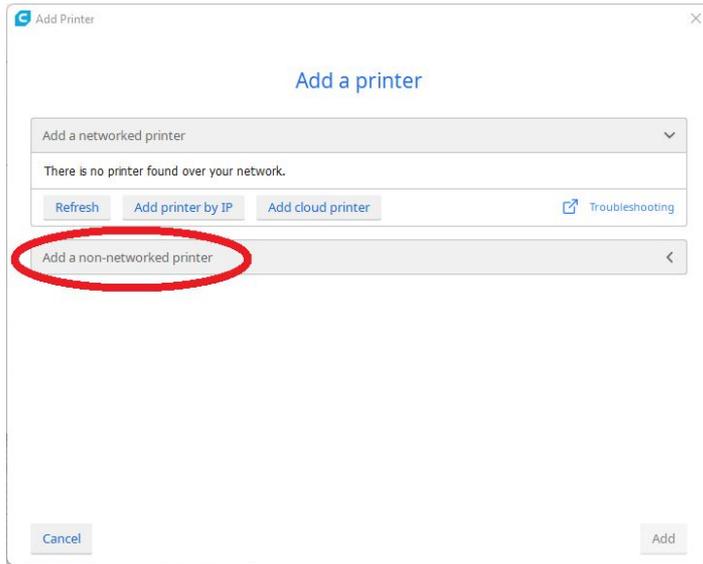- Settings and printing options selected
- Output file is called "G Code"

Slicing - Software

- Several options:
  - Cura
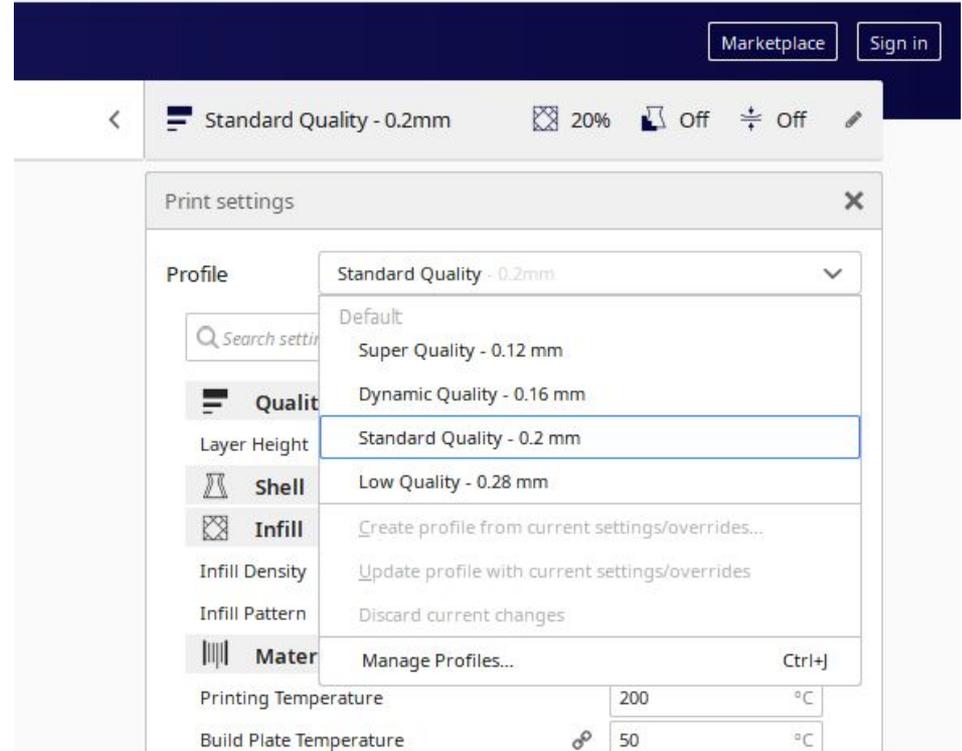 - Slic3r
  - Z-SUITE
  - OctoPrint

Slicing - Initial Setup
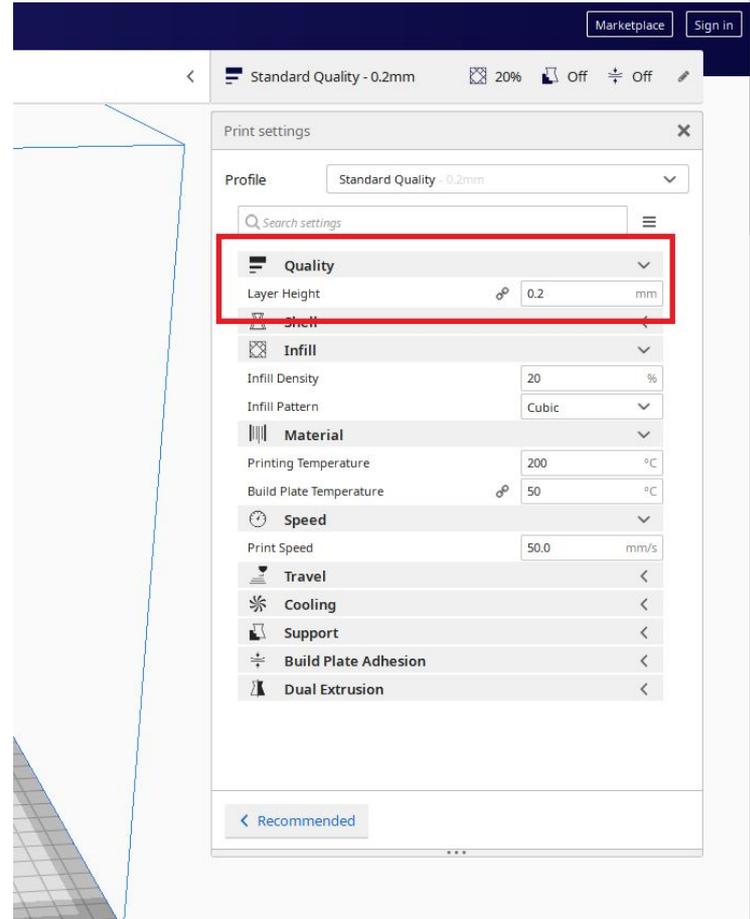
Add Ender 3 Printer:

Slicing - Basic settings

- Basic settings:
  - Layer height
  - Infill
  - Temperature
- Easy settings profiles are typically available

Slicing - Layer Height

- Small layer heights
  - Higher resolution
  - Smoother curves
  - Longer print times
- Large layer heights
  - Low resolution
  - Faster print times
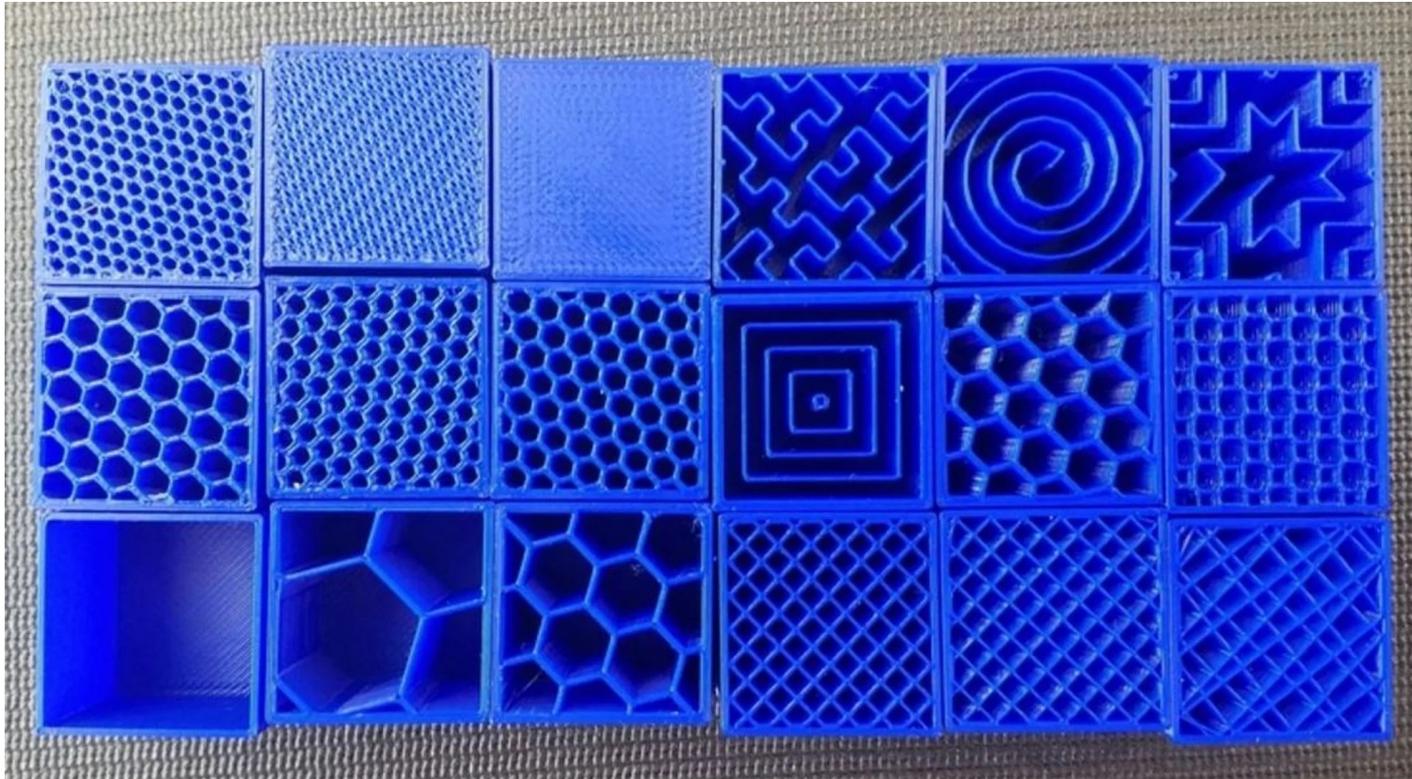- Settings profiles based on layer height

Slicing - Infill

- Parts can be completely hollow, completely solid, and everywhere in between
- Specified with a pattern and percentage
- Usually 10-20% filled is recommended
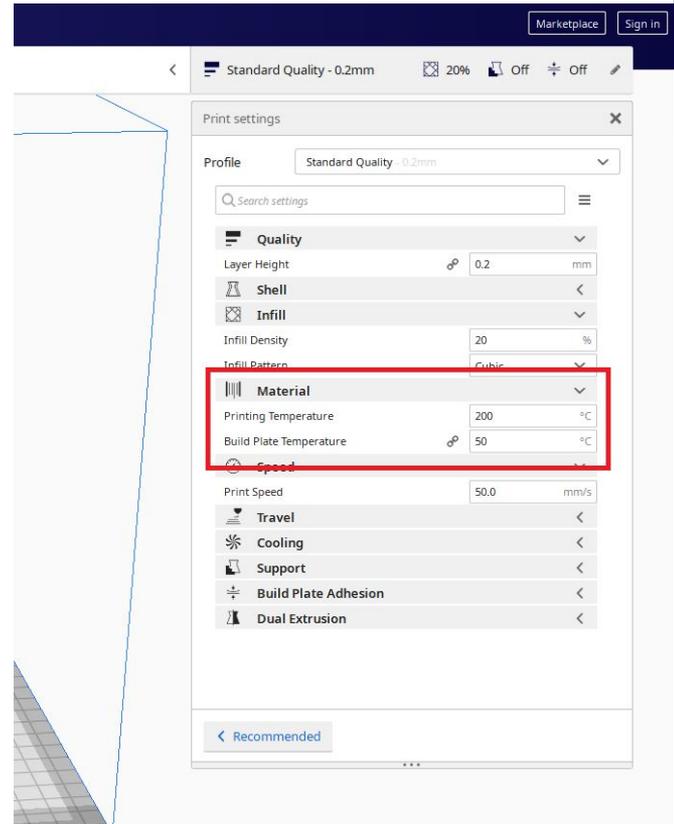- Largely affects how strong a part will be
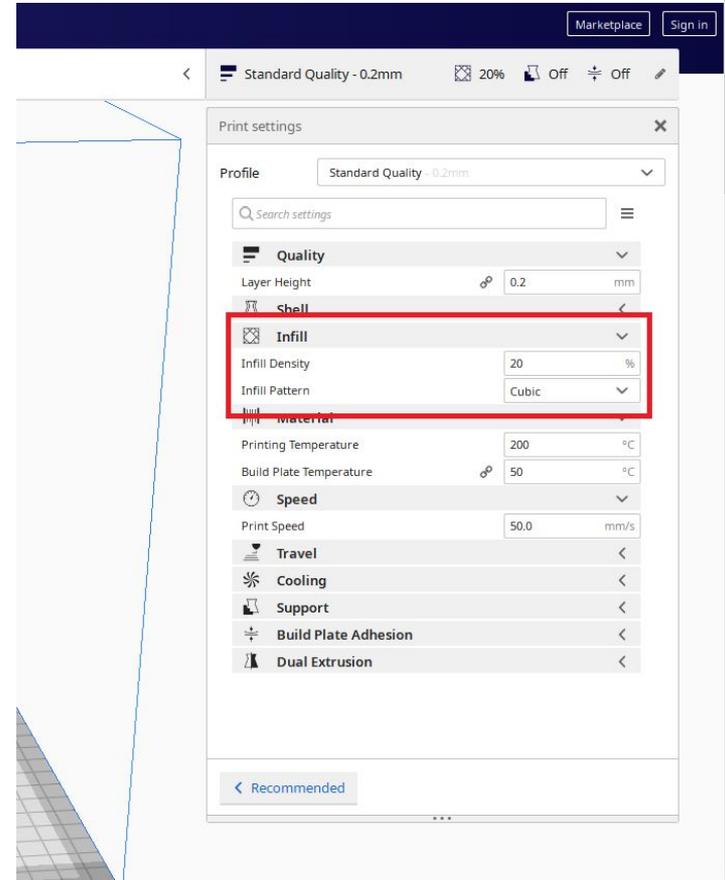
Slicing - Infill
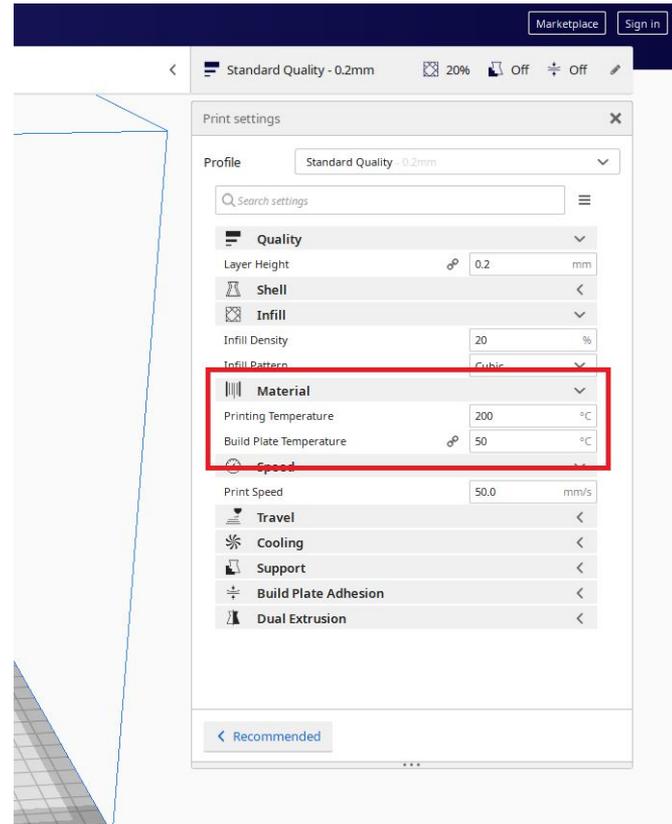
Slicing - Temperatures and Materials

- PLA:
  - Very easy to print with
  - Good for general use
  - Nozzle temp: 190-210 degrees
  - Bed temp: 50-60 degrees

Slicing - Temperatures and Materials

- PETG
  - Intermediate printing difficulty
  - Disable or limit cooling
  - Very strong
  - Nozzle temp: 230-250 degrees
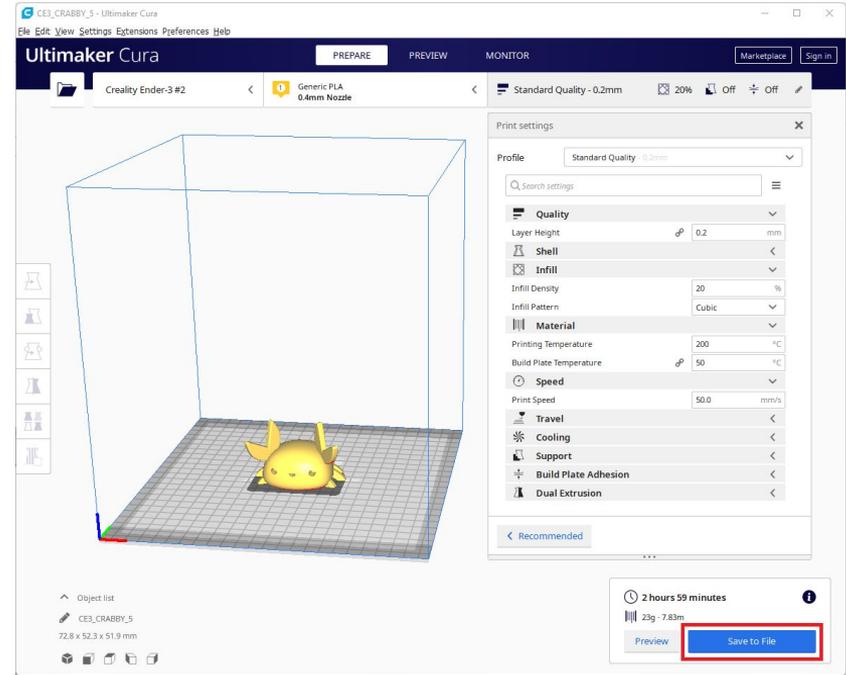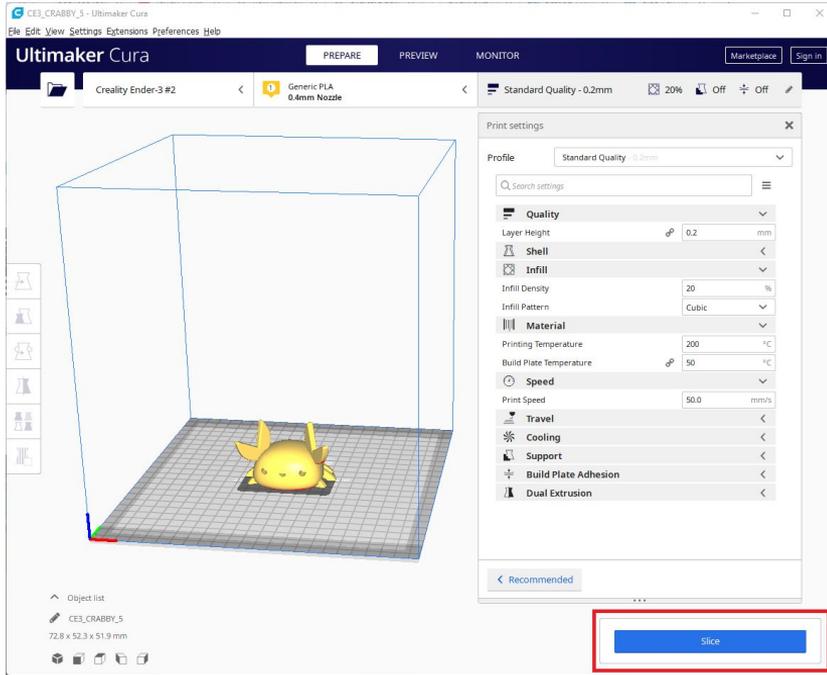 - Bed temp: 70-80 degrees

Slicing - Temperatures and Materials

- Other Materials
  - ABS
  - Flexible
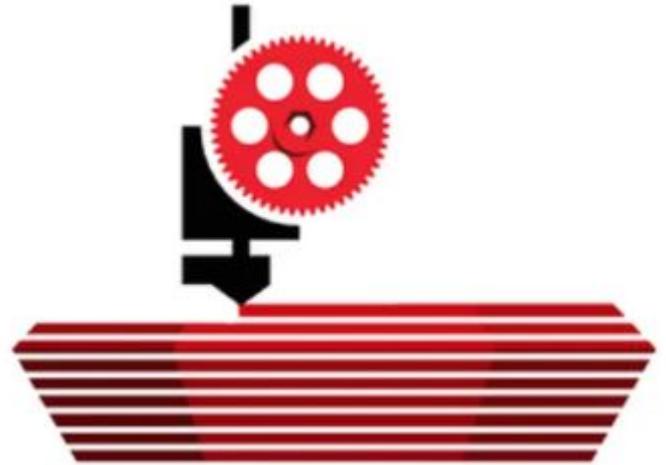 - Nylon
  - Polycarbonate
- Temperatures printed on spool

Slicing - Exporting G Code to SD Card

Printing

- Insert SD card
- Preheat printer
- Select "Print from TF"
- Browse to your file and select it
- Watch first layer to make sure there are no issues

Bed Levelling

- Bed Leveling
  - Adjusting the height of the corners of the bed to set the correct and consistent height between it and the nozzle
- Bed Levelling is the number one reason your print might be failing

Bed Levelling