

# 3D Printing

## Cheat Sheet

# FDM Materials Quick Reference

| Material | Nozzle Temp | Bed Temp | Properties                 | Best For                       |
|----------|-------------|----------|----------------------------|--------------------------------|
| PLA      | 190-220°C   | 20-60°C  | Easy, biodegradable        | Prototypes, visual models      |
| PETG     | 220-250°C   | 70-80°C  | Strong, chemical resistant | Functional parts               |
| ABS      | 220-250°C   | 90-110°C | Durable, heat resistant    | Enclosures (needs ventilation) |
| TPU      | 210-230°C   | 20-60°C  | Flexible, rubber-like      | Gaskets, grips, wearables      |

# Key Print Parameters

| Parameter    | Values                                    | Notes                          |
|--------------|-------------------------------------------|--------------------------------|
| Layer Height | 0.1 – 0.3mm                               | Smaller = smoother, slower     |
| Infill       | 10 – 50%                                  | 20% decorative, 50% functional |
| Print Speed  | 40 – 80mm/s (highly dependent on printer) | Slower for detail              |
| Supports     | Auto / Tree                               | Required for overhangs >45°    |
| Walls        | 2 – 4 lines                               | More walls = stronger          |

\*If available start with material presets and tweak them later if required

# Software

## Slicer Software

### PrusaSlicer

[prusaslicer.com](https://prusaslicer.com) — Excellent defaults, advanced features

### OrcaSlicer

[github.com/SoftFever/OrcaSlicer](https://github.com/SoftFever/OrcaSlicer) — Modern UI, calibration

### Cura

[ultimaker.com/software/cura](https://ultimaker.com/software/cura) — Beginner-friendly

## CAD Software

### Fusion 360

[autodesk.com/fusion-360](https://autodesk.com/fusion-360) — Professional parametric (free for hobbyists)

### FreeCAD

[freecad.org](https://freecad.org) — Open source parametric CAD

### Blender

[blender.org](https://blender.org) — Organic modeling, sculpting

### TinkerCAD

[tinkercad.com](https://tinkercad.com) — Browser-based, great for beginners

# Online Generators

## Box & Enclosure Generators

### **boxes.py**

[festi.info/boxes.py](http://festi.info/boxes.py) — Comprehensive parametric boxes

### **MakerCase**

[makercase.com](http://makercase.com) — Simple box generator

### **MakeABox**

[makeabox.io](http://makeabox.io) — Laser-cut box designs

### **3axis Box Generator**

[3axis.co/tools/laser-cut-box-generator](http://3axis.co/tools/laser-cut-box-generator)

## Storage & Organization

### **Gridfinity Generator**

[gridfinitygenerator.com](http://gridfinitygenerator.com) — Modular storage system

### **Gridfinity (Bouwens)**

[gridfinity.bouwens.co](http://gridfinity.bouwens.co) — Alternative generator

### **Gridfinity (PerplexingLabs)**

[gridfinity.perplexinglabs.com](http://gridfinity.perplexinglabs.com) — Customizable bins

## Mechanical Parts

### **Thread Generators**

[MakerWorld customizers](#), [threadmodeler.com](http://threadmodeler.com)

### **Gear Generator**

[geargenerator.com](http://geargenerator.com) — Spur and planetary gears

# Model Libraries & Print Services

## Model Libraries

### Printables

[printables.com](https://printables.com) — Curated, high quality (Prusa)

### Thingiverse

[thingiverse.com](https://thingiverse.com) — Largest collection

### MakerWorld

[makerworld.com](https://makerworld.com) — Bambu Lab ecosystem, good customizers

### Thangs

[thangs.com](https://thangs.com) — AI-powered search

## Print Services

### JLCPCB / PCBWay

Low-cost SLA/SLS, fast shipping from China

### Shapeways

Wide material selection, metals

### Craftcloud (All3DP)

[all3dp.com/craftcloud](https://all3dp.com/craftcloud) — Price comparison

### Local Makerspaces

ZHdK Lab, FabLab Zürich ([fablab.ch](https://fablab.ch))

# Troubleshooting Quick Fixes

| Problem         | Solution                                   |
|-----------------|--------------------------------------------|
| Warping         | ↑ Bed temp, add brim, check for drafts     |
| Stringing       | ↑ Retraction, ↓ temp, dry filament         |
| Layer Shift     | Check belt tension, ↓ speed, secure cables |
| Under-extrusion | Clean nozzle, ↑ temp, calibrate e-steps    |
| Poor Adhesion   | Level bed, clean surface, use glue stick   |
| Elephant Foot   | ↓ Bed temp, reduce first layer squish      |

# Advanced Techniques

## Pause & Insert

Add objects mid-print:

1. Design cavity in model
2. Use "Pause at layer" in slicer
3. Insert magnet/nut/LED
4. Resume print

## Print-in-Place

Moving parts printed assembled:

- Hinges, chains, ball joints
- Captive gears & mechanisms
- Flexible living hinges

Tip: 0.2-0.4mm gaps for clearance

## Multi-Material

Combine filaments:

- M600 — Color change G-code
- PVA — Water-soluble supports
- Flexible + rigid combos
- Requires dual extruder or AMS