

## **3D Printing Guide (2026 Edition)**

## 1. Choosing Your Technology: FDM vs. Resin

While there are many types of 3D printing, beginners almost always choose between the two outlined below:

FDM (Fused Deposition Modeling) – *Highly Recommended for 3D-printed Prosthetics*

1. How it works: Melts plastic filaments and “draws” layer by layer.
2. Best for: Household tools, toys, cosplay, and **functional parts**.
3. Pros: Very easy to use, wide variety of materials, safe for home use (no toxic liquids).
4. Cons: Visible layer lines, not as good for tiny "Dungeons & Dragons" style miniatures.

Resin (SLA/DLP) – *More Detailed, but Brittle*

1. How it works: Uses a UV light to harden liquid chemicals in a container.
2. Best for: Intricate jewelry and tabletop miniatures.
3. Pros: Incredible, glass-smooth detail.
4. Cons: Messy, requires gloves/mask, toxic fumes, extremely brittle. Resin is not recommended for printing functional parts.

## 2. An Introduction to Industry-Standard 3D Printers.

Prices are based on most recent estimations and does not include filament cost.

### Entry-Level (Under \$300)

1. **Creality Ender 3 V3 SE (~\$180):** The classic "tinkerer" machine. It's affordable and produces great results but requires manual maintenance.
2. **Bambu Lab A1 Mini (~\$219):** Small but accessible. It features full auto-calibration and is the most reliable "out of the box" experience for beginners.
3. **Elegoo Centauri (~\$270):** A newer speed-focused budget printer using the CoreXY motion system for faster, more stable prints.

### Mid-Range (\$500 - \$1000)

4. **Bambu Lab P1S (~\$600 - \$700):** The reliable workhorse of the Bambu lineup. It is a fully enclosed CoreXY printer designed for those who want to print materials like ASA and ABS without the high price tag of the X1 series. However, it lacks some of the tech of the newly introduced P2S such as the AI camera.
5. **Bambu Lab P2S (~\$600 - \$700):** The successor to the famous P1S. It is fully enclosed, making it perfect for engineering materials like ABS and PETG. It features an improved AI camera for failure detection. Good as an investment for entry-level engineering. The P1S and P2S both offer 256 x 256 x 256 mm build volume.

6. **Prusa Core One (~\$1,000):** Prusa's premium enclosed machine. Known for incredible software support and long-term reliability.

### Higher End (~ \$1,000+)

7. **Bambu Lab X1 Carbon / X1C (~\$1,100):** The standard for engineering. It features a hardened steel nozzle and drive gears, making it ready for Carbon Fiber (CF) filaments out of the box. Its Micro-LiDAR system scans the first layer to ensure perfection and automatically calibrates flow. It is the go-to for professionals who need a "set it and forget it" desktop workhorse.
8. **Bambu Lab H2S (~\$1,249 - \$1,400):** The "S" stands for Single Extruder. This is Bambu's large-format answer, offering a massive 340 x 320 x 340 mm build volume. It features a 65°C active chamber heater, which is essential for printing large helmets or industrial parts without warping.
9. **Bambu Lab H2D (~\$1,800 - \$1,999):** The "D" stands for Dual Independent Extruders. This is the ultimate engineering machine. It allows you to print with two different materials at once. For example, you can use a water-soluble support material for complex internal geometries, or combine rigid plastic with flexible TPU in a single print without constant filament switching. It eliminates the "purge waste" commonly seen in single-nozzle multi-color printers.

### 3. A Filament Guide

Material choice determines the strength, look, and heat resistance of your print.

Material	Ease of Use	Strength	Heat Resistance	Best For
<b>PLA</b>	★★★★★	Medium	Low (55°C)	Decorative models, prototypes, toys.
<b>PETG</b>	★★★★☆	High	Medium (75°C)	Planters, mechanical clips, outdoor use.
<b>TPU</b>	★★★☆☆	Low	Medium (70°C)	Gaskets, phone cases, flexible tires.
<b>ABS/ASA</b>	★★☆☆☆	Very High	High (100°C)	Car parts, tools, UV-resistant outdoor gear.
<b>Nylon (PA)</b>	★☆☆☆☆	Extreme	High (120°C+)	Gears, heavy-duty structural parts.
<b>PC</b>	★☆☆☆☆	Extreme	Extreme (140°C)	Clear parts, high-impact industrial tools.

## Specialty Filaments

- **Silk PLA:** Contains elastomers that give it a high-gloss finish.
- **Wood-Filled:** Contains actual sawdust; can be sanded and stained like real wood.
- **Metal-Filled:** Contains metallic powder and requires a hardened steel nozzle. It is heavier than its counterparts.
- **CF-Infused (Carbon Fiber):** PLA or PETG mixed with carbon fibers. It makes the parts incredibly stiff and gives them a premium matte finish. Requires a hardened steel nozzle.

## 4. The 3D Printing Software Workflow

To get a print, you follow three distinct steps:

### Step 1: CAD / Modeling

- **Tinkercad:** Free, web-based, and uses "shape-building" (great for kids/beginners).
- **Fusion 360:** Free for hobbyists; allows for precise engineering.
- **Blender:** Best for artistic sculpting (characters, organic shapes).
- **Onshape:** Good for CAD and has tutorials.
- **Solidworks:** Robust and intuitive CAD interface.

### Step 2: Slicing

Export your CAD model. .STL or .STEP work. Your 3D file then must be "sliced" into layers and converted to printer-readable G-Code.

1. **Bambu Studio / OrcaSlicer:** The modern favorites. They offer "one-click" printing and cloud monitoring. It is important to note that while OrcaSlicer is compatible with BambuLab printers, it requires some manual setup. However, Bambu Studio is fully integrated with BambuLab printers. If you are printing for sensitive or military applications, it is recommended not to use Bambu technologies due to its cloud-based nature and affiliation with Chinese companies.
2. **UltiMaker Cura:** The most famous open-source slicer, compatible with almost every printer ever made.
3. **PrusaSlicer:** Known for having the best support-generation algorithms.

### Step 3: Printing (G-Code)

The Slicer creates a **.gcode** file. This is a list of coordinates (X, Y, Z) telling the printer exactly where to move and how much plastic to melt. You send this to the printer via Wi-Fi or a physical SD card. The print begins.

## 5. Maintenance & Safety Checklist

1. **Ventilation:** If printing ABS, ASA, or Nylon, you must use an enclosure with a carbon filter or vent the air outside.
2. **Bed Cleaning:** Finger oils prevent prints from sticking. Wipe your build plate with 90% Isopropyl Alcohol every few prints.
3. **Nozzle Clogs:** Keep a "cold pull" needle or a spare nozzle handy. In 2026, most Bambu and Creality printers have replacement nozzles that can be installed easily.
4. **Dry Your Filament:** Plastic is "hygroscopic" (it absorbs humidity). If your printer sounds like it's "popping," your filament is wet. Use a dedicated Filament Dryer (\$50).