**Printer: Basic Skills Worksheet Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**NOTE:** Those of you have have 3D printers or significant previous experience please watch and listen and allow those who are new to this the opportunity to learn and experience. I would welcome any comments that you might have to improve this lab experience.

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|  | **TASK** | **Notes** | **Check** |
| 1 | **Turn on the Printer** (where is the switch?)  As it boots the firmware version number will be displayed – what is it?  After booting you will land on the Info Screen which shows various temperatures  Push black selector knob to return to Main Menu. Rotate selector knob to explore menu options.  If you wait (90 s I think) without doing anything the display will return to the Info Screen. You can also select Info off menu. |  | ❏ |
| 2 | **Remove/Replace Build Plate**  Check that bed temperature is below 40 C on Info screen. Note that body temp is roughly 37 C.  Notice positioning of alignment studs at back of the build plate. These are the two little buttons that fit into the corners of the build plate.  To remove the build plate (which is magnetically stuck to the underlying bed) place thumbs (2) on ‘labelled’ tabs and fingers under each corner. Gently lift to remove plate  **NOTE!:** Take care as you replace the build plate. The magnets are strong and you can easily pinch fingers as it snaps down into place.  Replace build plate taking care to position alignment studs at the back in proper location. |  | ❏ |
| 3 | **Load/Unload SD Card**  Gold contacts on SD card face ‘up’. Insert in SD slot.  LCD will take you immediately to the files on the SD card. Return to Main Menu by pushing selector knob.  Pull and replace SD card so you know this is OK when NOT printing.  Select ‘Print from SD Card’ from main menu to get to SD card files.  Return to Main Menu |  | ❏ |
| 4 | **Preheat Printer**  From Main Menu select ‘Preheat’. Choose PLA settings. Note the temperatures: 215 is nozzle temp, 60 is bed temp. These are temps that you should expect to see when things are functioning correctly.  **NOTICE:** Note the red led on the connector at the back left of the bed. This is an indication that the bed heater is turned on. This is a good visual indicator that the bed and build plate are likely to be hot.  Return to Info screen and watch the temperature of the nozzle and the bed rise. IF the filament is loaded you may see some extruder drool coming down. Feel free to remove it using plastic tweezers (to avoid damaging fingers or nozzle)  When temperatures have reached targets LIGHTLY touch the bed so you have a sense of how hot it actually is. This will not burn you unless you are foolish. |  | ❏ |
| 5 | **Load/Unload Filament**  IF the printer thinks the filament is loaded then there will be an ‘Unload’ option on the Main Menu. There will be filament entering the top of the extruder. IF the printer thinks there is no filament there will be an ‘Autoload’ option on the Main Menu.  **Finish this task with filament properly loaded into the extruder.**  **AutoLoad:**  If filament is NOT loaded then first check the free end of the filament to assure that it has no bulge or deformation. IF needed cut filament with small side cutters on diagonal.  Select AutoLoad from Main Menu. As you feed the filament into the top of the extruder (should go smoothly) you will feel the feed wheel catch and pull the filament.  Watch for extrusion of filament from nozzle. LCD will ask if filament is correct color. If not then there may be an extruder problem. Use plastic tweezers to remove nozzle drool.  **Unload:**  If the filament is loaded then select the ‘Unload’ option from the Main Menu.  The printer will first heat the nozzle head to the proper temperature (based on selected filament type).  When the nozzle is at the appropriate temperature the printer will chirp to get your attention. Push the knob while preparing to pull the filament out with your other hand. Screen will prompt you to pull which should easily remove the filament.  IF filament does NOT remove easily seek assistance from lab instructor. |  | ❏  ❏ |
| 6 | **First Print!**  Steps 7 – 14 are typical of a normal print process.    Step EE has been added so you know how to pause or stop a print in the event of an issue.  You will perform steps 7 and EE in quick succession so read them both before proceeding. |  |  |
| 7 | **Print from SD Card**  With SD card inserted select ‘Print from SD Card’ and find Coins>PennyHolderII\_v3.0…. In the file structure.  Don’t select the file for a moment and watch how the lengthy name slowly scrolls across. The Prusa system creates lengthy file names to help keep track of your printer settings but the LCD can only display about 24 characters at a time. IF the displayed characters match PennyHolderII\_v3.0 then you’re fine for this print.  Select this file to print by pushing the selector knob. |  | ❏ |
| EE | **Pause/Stop the Print**  As soon as you have selected the file to print the process will begin. Immediately return to the Main Menu and notice that there are two new options. ‘Pause Print’ and ‘Stop Print’. Select ‘Pause Print’ and observe what happens. Select ‘Resume Print’ (which wasn’t there before).  Now select ‘Stop Print’ and ‘yes’ to abort the print job.  Assuming all that went well return to Task 7 and start the same print again from the SD card. This time let the print continue. |  | ❏ |
| 8 | **Check Table Limits**  Notice that the first stage of every print is to check the table limits. This is the printers way of being sure it knows where it is. |  | ❏ |
| 9 | **Bed Level**  Then you will notice that the printer visits a number of locations around the build plate (how many and in what pattern?)  These are reference points that the printer uses to define the plane of the build plate. This is called bed leveling even though the bed is not changed at all. |  | ❏ |
| 10 | **Initial Wipe**  Then the printer extrudes some filament along the front edge of the build plate. This clears the nozzle and assures that the extrusion process is working appropriately. What do you notice about this pattern? What would you do if the pattern is incorrect? |  | ❏ |
| 11 | **Perimeter and Brim**  Typically the printer runs a line of filament around the build area and then creates the ‘brim’. The brim is an extension of the bottom layer to help assure the edges of the print remain attached to the build plate. I tend to use at least a small brim all the time but it is not explicitly required.  What would you do if either the perimeter or the brim seemed to be printing incorrectly? |  | ❏ |
| 12 | **Bulk of the Print**  This stage is the bulk of the print. On all prints it is best practice to stay at the printer until the first 3-4 layers have successfully printed.  Notice on the LCD screen in the bottom right corner it indicates the estimated time remaining for your print (00:10R) – hours and minutes, the R indicates remaining.  Because this is a short print stay an observe how it prints each layer. What part of the layer does it do first? How many ‘rounds’ does it do before filling in? Are the filling in patterns the same throughout the print- this might be easy to miss on this thin print? Does it print faster or slower at different times.  Notice if the temperature of the nozzle or bed changes throughout the print.  Depending on where you got the .gcode to execute the print the printer may want to unload the filament at the end of the process. I make a practice of setting a timer for a couple of minutes less than the remaining build time to remind me to get back.  The files I have provided for this lab should NOT ask you to remove the filament. If it does let me know. |  | ❏ |
| 13 | **Allow System to Cool**  If you return to the Info screen after the print is completed you may see that the nozzle and bed temps are NOT dropping. If this is the case then hit the reset button (orange X in the bottom right corner of the LCD panel) and when it returns to the info screen it will be cooling down.  Allow the bed to drop to at least 40 C before removing it. |  | ❏ |
| 14 | **Remove Print**  Generally speaking the initial wipe and the perimeter can be pulled off with a fingernail.  The best practice is to GENTLY flex the build plate (it is supposedly spring steel and shouldn’t crease) until a corner of the print lifts up from the plate. You should be able to pull the print off at this point.  In general you may use a plastic (so you don’t damage the build plate coatings) scraper to assist in removal. Larger or taller prints are generally easier to remove. |  | ❏ |
| 15 | **Examine the Print**  Examine the print for defects or features of interest. Are there any ‘strings’ attached to features of the print? Can you see the hollow space behind the inner edge? Is the inner edge of the print ‘flat’ or does it have shape?  Inspecting the print immediately after completion is a good general practice particularly if this is the first one of it’s kind. When you’re printing dozens of the same thing you’re presumably past this step. |  | ❏ |
| 16 | Done!! |  | ❏ |
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