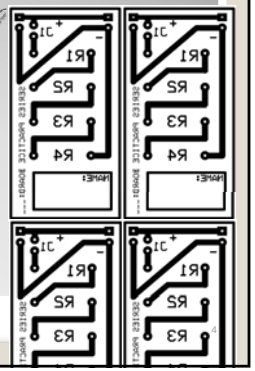
PRINTED CIRCUIT BOARD PRODUCTION

2

From your instructor obtain the laser printed transfer and cut just outside the thin line. Review your notes on safe use of scissors.



Step 1

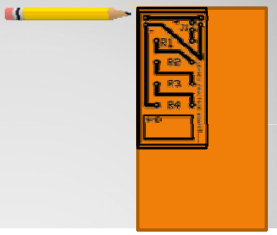
Learning Outcomes

I WILL BE ABLE TO:

- FOLLOW THE STEPS TO SAFELY PRODUCE A PRINTED CURCUIT BOARD.
- OPERATE THE TOOLS REQUIRED TO COMPLETE THIS PROJECT IS A SAFE AND EFFECTIVE MANNER.

3

From your instructor obtain a piece of printed circuit board (PCB). Using a pencil trace along the edge of your transfer. Make sure you efficiently use the the PCB. Do not waste.



Step 2

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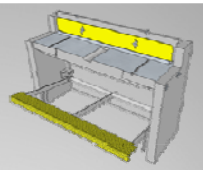
Use the Foot Shear to cut out the PCB. Caution: The foot shears can crush or sever your fingers if not properly operated. Review the procedures for safe handling of a foot shear. Then take a copper scrub pad and scrub the board until the copper is shiny.

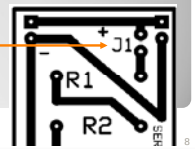


Step 3

Place the PC board (copper side up) on a wood board. Then place a sheet of paper towel on top of the PCB. Using a clothes iron at its highest setting (linen), heat the board for 4 minutes. Move the iron in a circular motion to provide even heat. Caution: The clothes iron will be above 200°C and can lead to first and second degree burns. Review the procedures for safe handling of a clothes iron.

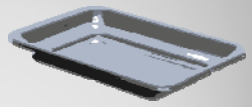
Step 4

Remove the paper towel and place the transfer down on the PCB making sure you can read the letters and numbers (shiny side of transfer up). Put the paper towel back on top and heat the board with the iron for another 2 minutes. Remember to move the iron around in a circular pattern. Lastly, remove the paper towel and take the tip of the iron and press down on the pathways, pads and letters.



Step 5

Cool the board in a tray of cool tap water. After 30 seconds pull the board out and peel off the transfer making sure one end is held tight with your thumb and the other end is held tight and lifted straight up (not rolled back).



Step 6

If 85% of the image has transferred over to the copper board from the image, then you are ready for the next step. If it is less than that, use the copper scrub pad to clean the copper board and go back to step 4.

Use the permanent markers (fine and ultra fine) to fix up areas that did not transfer. Go over three times to make sure the marker stays on during the etching process. Also put your initials on the board.

Step 7

10

Ferric Chloride is a corrosive material which reacts to metal. It can also irritate and damage skin and eyes. Therefore certain precautions must be followed.

Personal Protective Equipment:
- Safety Glasses
- Protective Gloves
- Apron

NOTE: ONLY YOUR INSTRUCTOR WILL PUT IN AND TAKE OUT THE PCBs INTO THE FERRIC CHLORIDE.

Safety: Ferric Chloride

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The board is ready to be etched. This process is done *only by your instructor*. The board is placed into a tank of Ferric Chloride where a chemical reaction removes the copper that hasn't been protected by the toner and permanent marker. This process takes anywhere from 30 minutes to an hour, depending on how many boards have been etched in the past.

Step 8

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Section 4: First Aid Measures

Exposure Condition	*GHS Code: Precautionary Statement*
IF IN EYES	P305
Symptoms	Immediate: *burns, severe irritation, redness, pain*
Response	P351: Rinse cautiously with water for several minutes. P338: Remove contact lenses, if present and easy to do. Continue rinsing. P310 : Immediately call a POISON CENTRE/doctor
IF ON SKIN	P302
Symptoms	Immediate: *redness, pain, brown stain on skin*
Response	P352: Wash with plenty of water. P361: Take off immediately all contaminated clothing and wash it before reuse.
If skin irritation occurs	P313: Get medical advice/attention

Safety: Exposure to Ferric Chloride

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Section 4: First Aid Measures	
IF INHALED	P304 (*Not a likely route of exposure under normal use*)
Symptoms	Immediate: *irritation, cough, sore throat*
Response	P340: Remove person to fresh air (out of the contaminated zone) and keep comfortable for breathing.
If feeling unwell	P312: Call a POISON CENTRE/doctor
IF SWALLOWED	P301 (*Not a likely route of exposure under normal use*)
Symptoms	Immediate: *Abdominal pain, irritation, nausea, vomiting, diarrhea*
Response	P330: Rinse mouth. P331: Do NOT induce vomiting. If conscious, give water to drink.
If feeling unwell	P312: Call a POISON CENTRE/doctor

From: MG Chemical's MSDS

Safety: Exposure to Ferric Chloride

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Remind your instructor to check your board every 10 minutes. The board can be over etched which will ruin the board. Once done, your instructor will rinse off any remaining etchant solution. Dry the board and then scrub off the image using the copper scrub pad which will expose the copper that was left behind.

Have your instructor check every 10 minutes.

Step 9

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Section 6: Accidental Release Measures	
Personal Protection	See Section 8. Avoid breathing the mist/vapors.
Containment	Contain with inert absorbent (such as soil, sand, vermiculite).
Cleaning	Neutralize with lime ($Ca(OH)_2$ or $CaCO_3$) or soda ash/sodium carbonate (Na_2CO_3). Collect liquid in a plastic container. Wash spill area with soap and water to remove the last traces of residue.
Disposal	Dispose of spill waste according to Section 13.

From: MG Chemical's MSDS

Safety: Cleanup of Ferric Chloride

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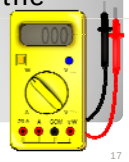
Take a multimeter and set it for continuity testing. On your board test all the pathways to make sure there are no breaks or shorts. There should be a beeping sound from the meter if there is a connection. If you do find a break, use the permanent marker to identify the spot. Later this fault can be fixed. If there is a short use a pencil knife to separate the pathways. Caution: A Kevlar glove must be warn while using the knife.



Step 10

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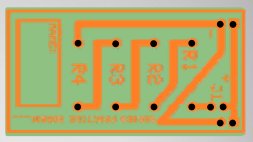
Then mark the centre of the pads With the permanent marker. This will help in not missing a hole while drilling.



Step 10 Continued…

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Following the safety procedures and rules is important to the well being of yourself and your classmates. Failure to these rules will result is a review of shop safety procedures and a possible termination of your project.

Your board is now ready for the components to be placed and soldered into place.

☹ Last Slide ☹

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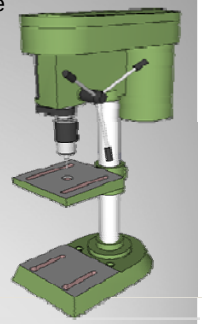
The next step is to drill the holes in the board. A number 60 drill is used. Do not force the drill through the material or it will break. Caution: It is a ***must*** that safety glasses are worn. Also, long hair must be tied back and you cannot wear loose clothing. . Review the procedures for safe operation of a drill press.

After the holes have been drilled rub a fingernail across the holes to remove any copper burrs. These burrs can later cause shorts on the board.



Step 11

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