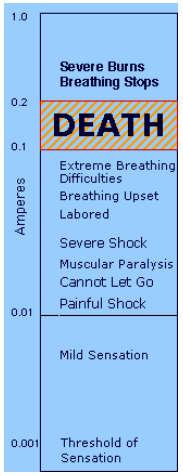
Safety is number one priority!

- Electric shock
- Electrocutions
- Fires
- Explosions
- Toxic substance (e.g. solder fume, heavy metals like lead)

Emergency Response Preparedness

For example, do you know where the panel and circuit breaker are located?

How much voltage is safe for a human body?



- Actually it's the **current** that *kills*!

- Ohm's law again.
- Resistance varies from person to person, also depends on current flow path.
- Body has capacitive property, so it withstands less AC current.

120V is deadly dangerous!

Prevent Electric Shock

- Ensure tools are Grounded or reinforced insulated (check the transformer you made).
- Use Ground Fault Circuit Interrupter (GFCI).
- Cover your open frame power supply.
- Tape any bare wire/connection joint (no exposed wire splices).
- Always use only one hand when possible to adjust testing devices.
- Apply lock-out/tag-out.
- Discharge capacitors before service.
- Be aware of emergency response.

Prevent Electrical Fires and Explosions

- Adequate wire size.
- No loose electrical connections (high resistance → high power dissipation → over heating).
- No flammable materials.
- Sufficient electrical clearance (note the heatsink is conductive).
- Check thermal design and components' power rating.
- Cover the open frame and prevent spilled liquid.
- Batteries and capacitors can explode (a polarized capacitor can blow up in seconds if mis-connected).

Prevent Toxic Materials

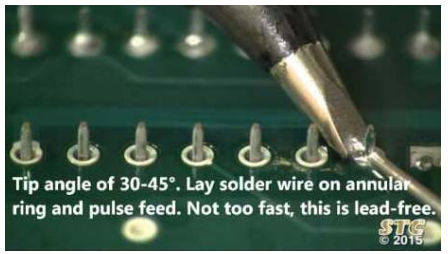
- Always use solder fume extractor.
- Use lead-free solder wire? (higher process temperature, less reliable assembly).
- Use lead-free components (electronic component packaging).
- **RoHS** (EU directive on the Restriction of certain Hazardous Substances)

Lead - Pb	0.1% Max Concentration
Mercury - Hg	0.1% Max Concentration
Cadmium - Cd	0.01% Max Concentration
Hexavalent Chromium - Cr(V1)	0.1% Max Concentration
Polybrominated Biphenyls - PBB	0.1% Max Concentration
Polybrominated Diphenyl Ethers - PBDE	0.1% Max Concentration

Soldering Techniques

- How to expert?

- Google is your good friend.
- YouTube is good too.
- ***Practice*** is the key!!!



Soldering Tools

- Soldering iron
- Solder wire
- Solder flux
- Solder wick (desoldering braid)
- Solder sucker

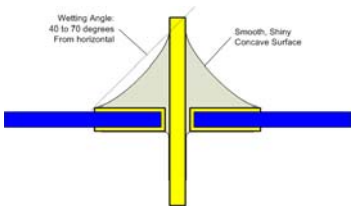
Soldering Procedure

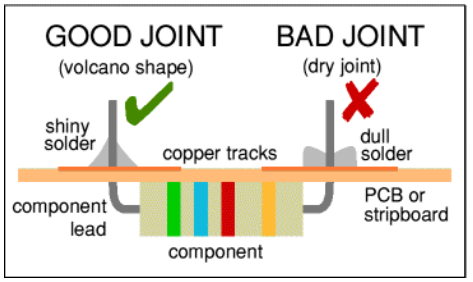
- Select appropriate iron tip (size, shape).
- Never reshape a tip with metal file!
- Clean all surfaces.
- Soldering temperature (normally < 800F).
- Apply solder flux (some solder wires are flux-cored).
- Put a little solder on the iron first (tinning).
- Heat the pin/pad (through-hole) while applying the solder to the opposite side of it.
- Remove corrosive flux residue (no need for non-corrosive fluxes).

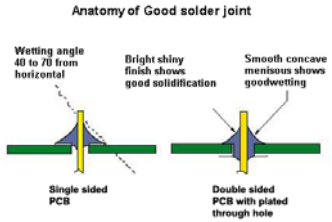
Soldering Tips & Tricks

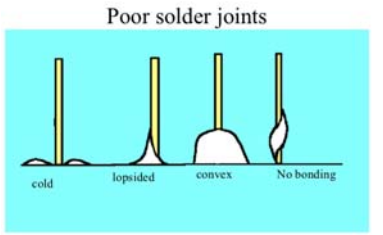
- Clean iron with wet sponge.
- Apply enough heat (iron temperature and heating duration) – MUST see solder melt and flow, but not exceed component's temperature tolerance.
- Use higher power iron or multiple irons (ask your teammate for help) for those pins that are connected to large area of copper. (solder the part without the heatsink attached).
- Surface-mount chips – get all pins soldered on first, and remove the bridges (they are easy to fix later).
- Tin the wire first when soldering a wire-to-wire or wire-to-pin connection.

Good or bad solder joint









These are not concave shaped solder joints

Common soldering problems