

Soldering Comic Book Companion Guide

Goal: To solder using the proper techniques and safety precautions.

Materials Needed:

- Comic Book Document <https://mightyohm.com/blog/2011/04/soldering-is-easy-comic-book/> (downloaded copy is provided with curriculum)
- Blank Prototyping PCB boards
- Grab bag of discrete through-hole components
- Soldering iron, 30-40 watts or temperature controlled. The tip should be no larger than 1/8" diameter, with a chisel or conical tip.
- Damp sponge or another tip cleaner
- Soldering Materials: Using lead with a small diameter (less than 0.030"), is recommended.
- Small wire cutters
- Something to hold the small PC board while you solder. (ex. "bulldog clip or binder clip").
- Magnifiers (optional)

Safety Precautions:

- Students should be not plug in or use the soldering equipment before reading the comic or without adult supervision.
- Make sure students wash their hands after using the soldering materials (especially the lead).
- Students should try to not breathe the rosin smoke that appears when soldering a connection.
- The soldering iron should be placed back in its stand as soon as the student is finished making a connection. Students should not hold the iron in between uses.
- Always hold the lead you are cutting with one hand while you make a cut with your other hand.
- Safety glasses are recommended.

Guided Reading Information

Page 1:

- See if the students recognize any of the drawings on the cover.
- Discussion Questions:
 - Have you ever soldered before? (Answers will vary)
 - Do you think it will be hard? (Answers will vary)
 - What should we be careful of when soldering? (Not getting burned, soldering in the wrong place, etc.)

Page 2:

- Read the content on page 2. Point out the Safety Tips to the students.
- Discussion Questions:
 - What makes up solder? (Usually tin and lead)
 - What melts immediately when you are soldering? (The rosin)
 - What does the rosin do as it flows around what you want to solder? (Cleans the metal and helps make a good solder connection)
 - What is a rosin core with 60% tin and 40% lead called? (Flux)
 - Why should you wash your hands after soldering with lead? (It's a poison.)

Page 3:

- Read the content on page 3. You can hold up some of the real parts as you read through the explanations of what they are.
- Discussion Questions:
 - How does a circuit work correctly? (Everything necessary should be connected to each other and to not anything that isn't needed.)

- What are some other names for the Printed Circuit Board? (PCB or “the board”)
- What are all the wires that stick out of the parts called? (leads)
- Should we be careful because some parts go in the wrong way? (Yes)

Page 4-5:

- Read the content on pages 4-5. You can display some of the real parts as you read through the explanations of what they are. You can also demonstrate the steps as you read over the content with the students.
- Discussion Questions:
 - Describe a resistor. (It has 2 leads and can be placed in either direction.)
 - How does the PCB usually mark where resistor go? (With a “R”, followed by a number)
 - What does the number mean? (It tells which resistor from the parts list is needed.)
 - How should the part rest when the leads are pushed through the board? (Flush or flat)
 - Why should we clean the soldering tip each time we solder a connection? (The high heat causes the tip to oxidize which will prevent a good connection.)
 - Where should the solder go when making the connection? (Under the tip)
 - When should you pull the solder away from the tip? (When it starts to melt)
 - Should you pull the tip away when you pull the solder away? (No, you should wait 1 more second so the solder flows around the pad and the lead).
- After reviewing the content and safety precautions, you can allow the students to carefully practice making a solder connection using the prototyping boards and components. Students should take turns and not grab the soldering iron from each other. The iron should be placed back in its stand as soon as the student has completed a connection. Students should be careful of the rosin smoke and try to not breathe it in as they work.

Page 6:

- Read the content on page 6. Have the students inspect the connection(s) that they made. Does their connection cover the pad and lead? Is it a small bump? Does the solder cover more than one hole? Discuss what they could have done to make it better if their connection doesn't meet these standards.
- Discussion Questions:
 - If the hole can be seen or the solder is flat on the board, what can you do to fix it? (Repeat the procedure on pages 4-5, to add more solder to the connection)
 - If too much solder was used, how can you fix it?
 - Option 1: Hold the tip to the excess solder between the pads for 1 second and then bang the board against the work table to fling the excess on the table. If this occur, make sure the students not banging the board are at a safe distance away from the table.
 - Option 2: Shown the students how to use the solder sucker to remove the excess solder.
 - Is it easier or harder to solder several parts to a board at once? (Harder)
 - Does the order of parts that we solder to a board make any difference? (Yes, it can. It is best to solder the components from shortest to tallest).

Page 7:

- Read the content on page 7. You can display some of the real parts as you read through the explanations of what they are. You can also demonstrate the steps as you read the content. Point out the safety tips. Safety glasses are recommended during the cutting of leads.
- Discussion Questions:
 - Why do we cut the excess leads? (To ensure that they do not bend and short another lead or pad.)
 - The flat edge of the cutters should be parallel to what? (The PCB)

- What should you do with your hand that is not cutting? (Hold the lead that you are cutting.)
- What types of leads do not need to be cut? (IC Sockets or other leads that are very short)
- Have the students review the steps to make a successful connection (including safety tips.)

Page 8:

- Read the content on page 8. Use this page to discuss what they thought about the soldering process and how easy and fun soldering can be.