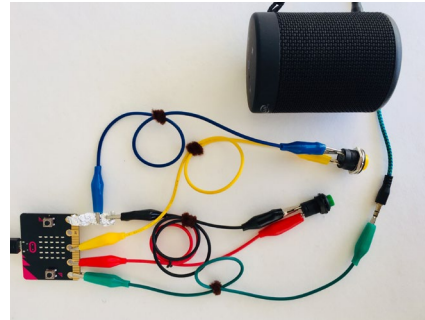


## WEEK 5

## CODING SOUND &amp; SWITCHES



## INTRODUCTION

In this session, makers continue to explore user interface and user experience (UI/UX) by connecting momentary and locking buttons to the Micro:bit microcontroller.



## ESSENTIAL QUESTIONS

- How can we connect buttons to the Micro:bit and code music for a fun, interactive experience?
- How do artists, engineers, and makers solve problems when they're working?



## LEARNING OUTCOMES

1. Learn how to connect buttons to the Micro:bit.
2. Learn how to code music blocks.
3. Engage in project-based learning through problem-solving and troubleshooting by creating a game with a Micro:bit and code.



## VOCABULARY

**User:** People playing/interacting with the game

**User interface (UI):** Physical and digital method or “interface” of how the user interacts with the game

**User experience (UX):** How natural, intuitive, and enjoyable those interactions are

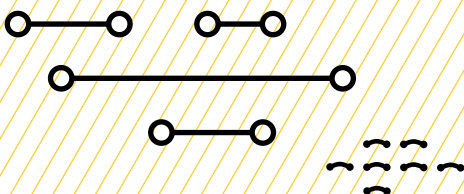
**Button (or switch):** Devices for making and breaking the connection in an electric circuit

**Momentary button:** Switch that doesn’t make contact unless it’s held down

**Locking button:** Switch that latches in a set position

**Speaker:** Device that receives and amplifies an audio signal so it can be heard

**Troubleshooting:** Using resources to solve issues as they arise

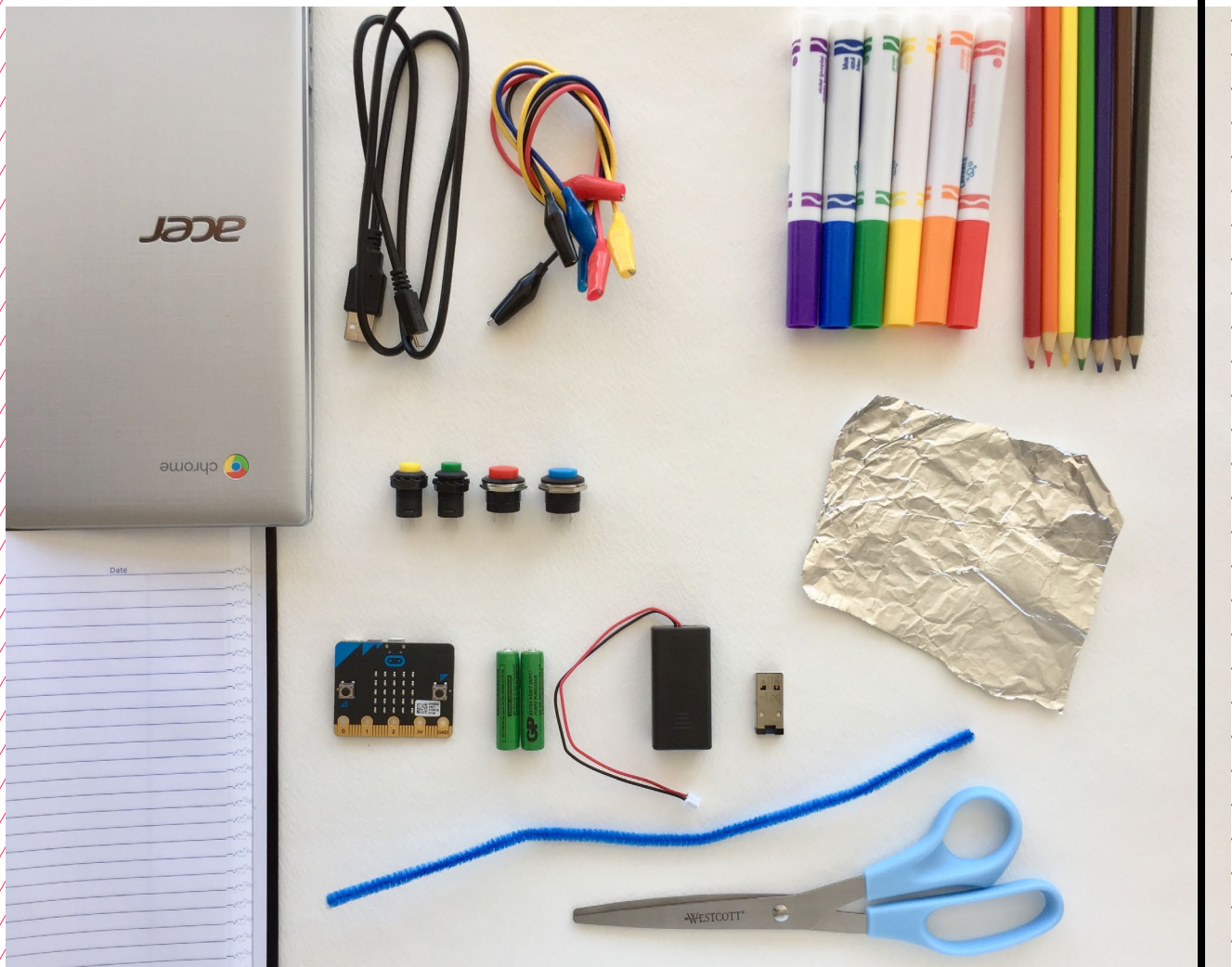


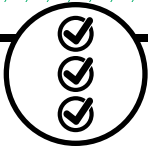


## MATERIALS LIST

### EACH PAIR OF MAKERS NEEDS:

- Micro:bit microcontroller
- Laptop with internet connection
- USB to micro-USB cord
- USB flash drive
- Battery pack
- AAA batteries (2)
- Alligator clips (4)
- Momentary buttons (2)
- Locking buttons (2)
- Notebook
- Markers or colored pencils
- Aluminum foil
- Pipe cleaner
- Scissors





## TEACHER PREP WORK

1. Ensure the internet connection is working, and connect your laptop to a projector or screen.
2. Preload videos and slideshow to save time.
3. Code the button keyboard in Step 2 and upload it to a Micro:bit as an example.
4. Set aside for each group: 2 momentary and 2 locking buttons, plus 4 alligator clips.
5. Print the [Troubleshooting Tips](#) at the end of the lesson and post in the classroom.

## FACILITATION TIPS

**Electronics:** Tinkering with electrical connections can be tricky, especially when connecting multiple alligator clips to one terminal on the Micro:bit. It can be helpful to extend the metallic terminal from Pin or GND with a small piece of aluminum foil or other conductive material (see the images in Step 3).

**Inspiring creativity:** Take note and celebrate surprising discoveries. Give makers opportunities to share the cool things they figure out with the rest of the class.

**Collaboration:** Let smaller issues work themselves out. Record specific positive examples that you can share with makers in the moment or at the end of the project. These examples provide models for all learners.

**Frustration:** When frustration levels aren't high, let learners figure it out or keep facilitation low touch by asking a question and walking away. When frustration levels are high, intervene more directly to help makers find some success.

Circulate among the makers and monitor for both collaboration and frustration.

## ADDITIONAL RESOURCES

[Connecting Audio to the Micro:bit](#)

[Creating a Controller for a Micro:bit Game](#)





# CODING SOUND & SWITCHES

## STEP 1



**Introduce buttons:  
momentary vs. locking.**



### EXPLAIN



Today, we'll continue programming the Micro:bit and connecting switches to play with the UI/UX. Let's check out some of these cool arcade switches and buttons. They might look familiar, similar to something you see on your game controller at home or at an arcade.

Next:

- Give each group 2 **locking buttons** and 2 **momentary buttons**.
- Let them play around with clicking them and see if they feel a difference.
- Ask them to draw one in their notebook, noticing what parts the buttons have and what they might do.

They'll probably notice that one of the buttons clicks but doesn't stay down, while the other clicks and stays locked. They have to press it again to unlock it.

### EXPLAIN



The button that clicks but doesn't stay down is a **momentary button**, and it only completes the circuit when the button is held down. The button that clicks and stays locked is a **locking button**. When you press this button, the circuit stays connected until pressed again. These buttons will be available as you continue to design UI/UX for your own games.

## STEP 2



**Code pins and music!**

### EXPLAIN

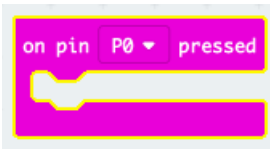


Now we'll continue exploring the Micro:bit, and learn how to program 2 pins to play different sounds. Then we'll connect 2 switches and a **speaker**! Choose your driver and navigator roles and let's begin. Navigators, watch closely and instruct your driver to follow these steps.

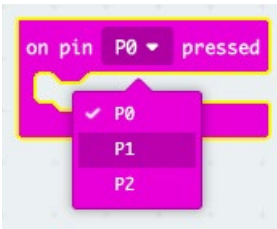
## DEMONSTRATE AND HAVE MAKERS FOLLOW ALONG:



1. Start by opening a new project. Then, click and drag an **on pin pressed** block from the **Inputs** menu into the coding space.



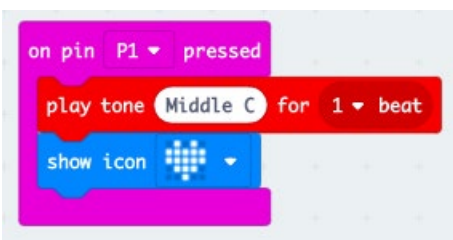
2. Click on the **P0 dropdown menu** and change it to **Pin 1**.



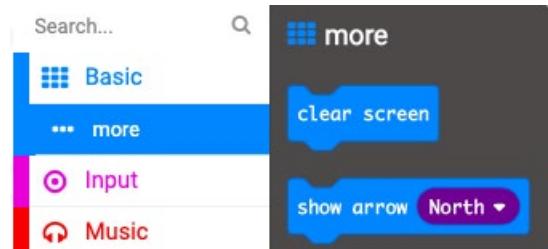
3. Next, go to the **Music** menu, drag over a red **play tone** block, and nest it into the first block.



4. Drag over a **show icon** block from the **Basic** menu and add it to the sequence.



5. Then, go to the **Basic** menu and click on **more** to find the **clear screen** block.



6. Drag over a **clear screen** block to add into the sequence.



7. Next we want to duplicate this entire sequence of blocks. We can do this a few ways:

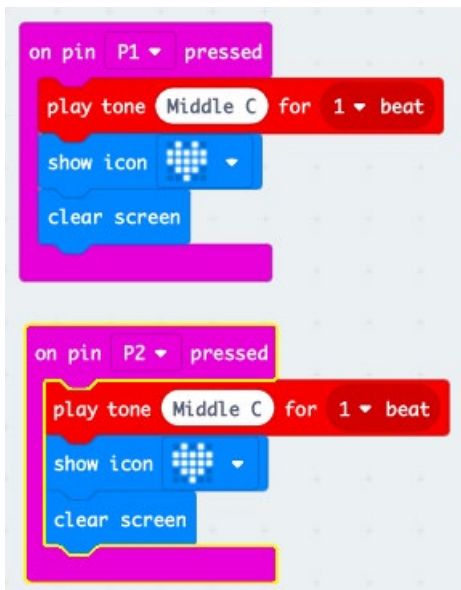
- Repeat Steps 1–6.
- Go to the top **on pin pressed** block and use two fingers to press down on the trackpad.
- Hold down the alt key and click on the block to show a dropdown menu. Then choose the Duplicate option.



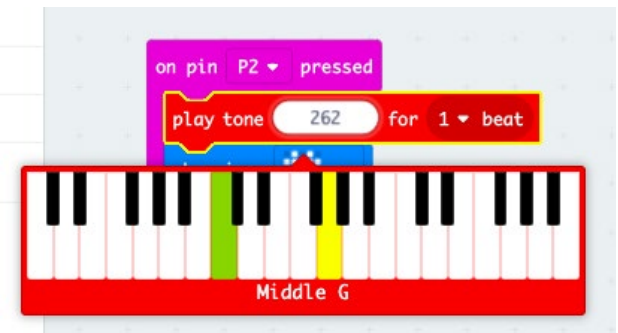
8. You should see a copy of these blocks, but one is greyed out because it's inactive.



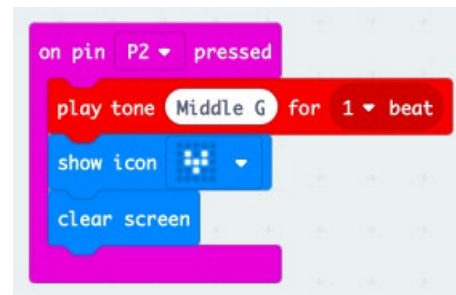
9. Change the first block to be **on pin P2 pressed**, and the blocks should be no longer greyed out.



10. Click on the text “Middle C” to change the note. You’ll see a keyboard pop up. You can choose any second note to play.



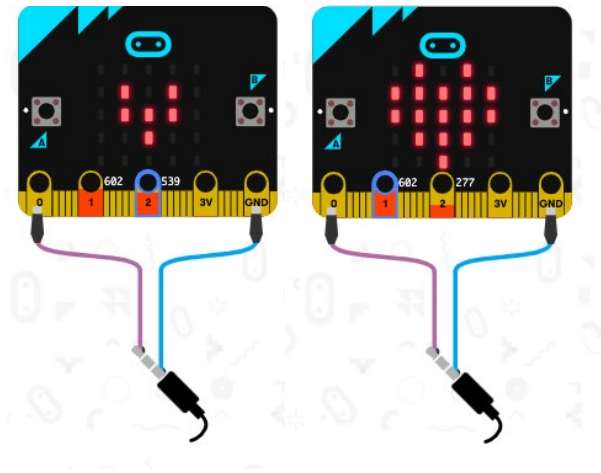
11. Next, change the **show icon** block display to be a small heart.



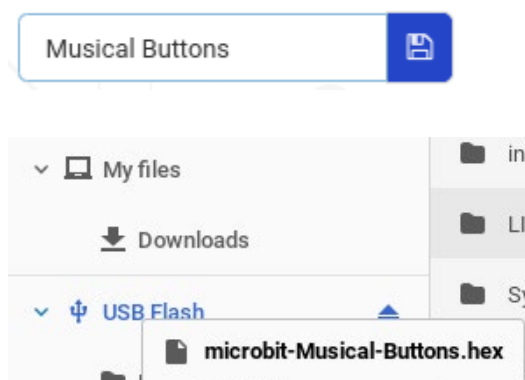
You should now have the two sequences of code shown here.



12. Next, in the simulator, test the code by clicking on **Pin 1** and **Pin 2**. You should hear the tones playing through the computer speaker!



13. Notice that the simulator shows **Pin 0** and **GND** connected by wires to the end of a plug. This is showing us how to connect to a speaker. We'll do that later, after we upload the code to our board.
14. Once we've coded the two sequences:
- Name the file with a unique name.
  - Save the file to the USB flash drive.
  - Connect the Micro:bit with the USB cord.
  - Click and drag the file into the Micro:bit to upload.



### STEP 3



#### Connect the pins.

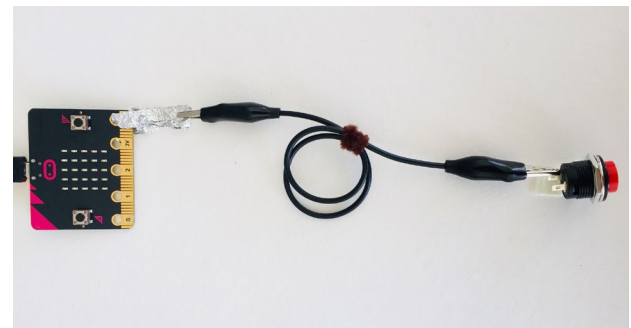
**Note:** Makers should leave the board connected to the laptop while doing this step to reduce troubleshooting issues from the battery pack.

It's time to connect 2 buttons to the board. Give each group 4 alligator clips. Have makers swap driver and navigator roles from the last step. (Drivers are the ones with their hands on the board with wires. Navigators instruct and support their partner to follow the steps below.)

#### DEMONSTRATE AND HAVE MAKERS FOLLOW ALONG:

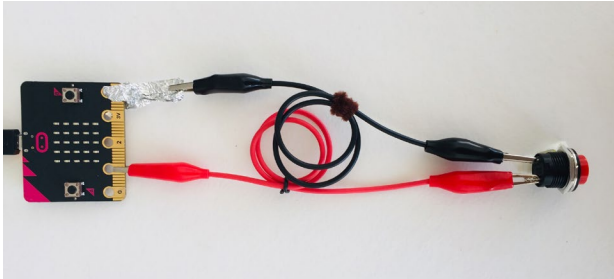


1. Connect an alligator clip to **GND** and the other side to one terminal of the **momentary button**. It can be helpful to twist some aluminum foil and loop it through **GND** because we'll be adding more alligator clips to **GND**.

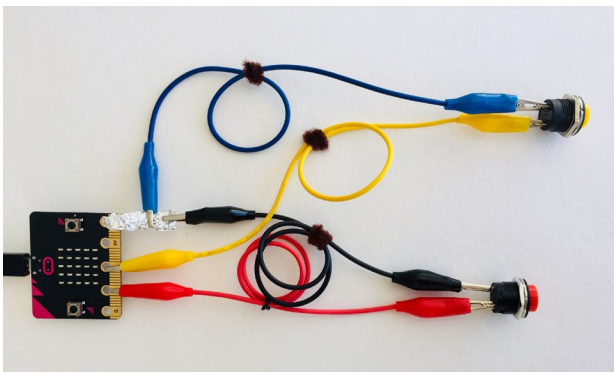
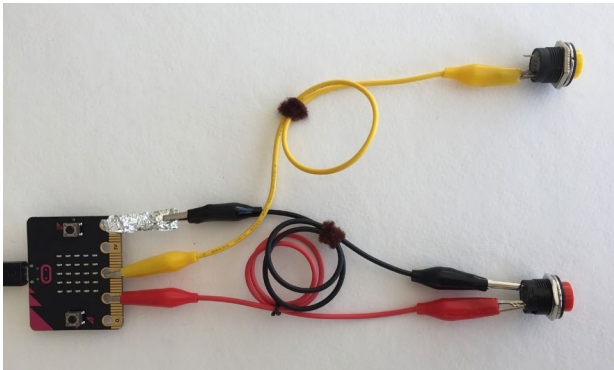




- Next connect an alligator clip to **Pin 1** and the other end of the alligator clip to the other side of the momentary button terminal.



- Repeat Steps 1 and 2 but connect to **Pin 2** with a second button. You can connect to the aluminum foil on **GND** or connect to the metal alligator clip that's already on **GND** because the metal clip is conductive.



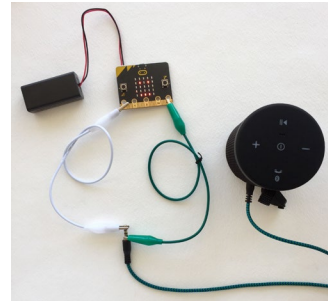
- When you press the button connected to Pin 1 and Pin 2, you'll see the animation of the heart but you won't be able to hear the music. This is because the Micro:bit isn't connected to a speaker. We'll connect a speaker during the next session.

**Note:** In Steps 3 and 4, anticipate that connections to the board and alligator clips will be tricky and inconsistent. Encourage makers to check to see if the connections are secure as they work. You can use a pipe cleaner to twist the alligator clips together so it's easier to see how the wires are connected.

## STEP 4



**Connect a speaker to the Micro:bit.**



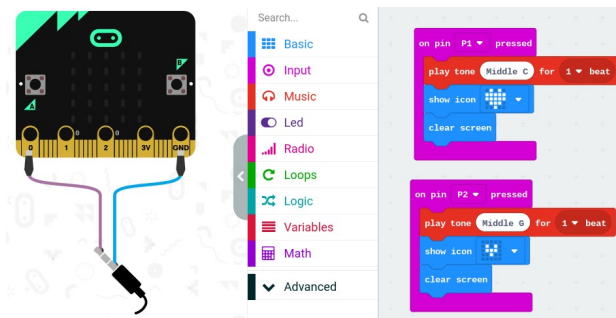
## EXPLAIN

The Micro:bit doesn't have a speaker on it, so even if the code is running, the audio signal has nowhere to be heard or amplified. Next, we'll connect to an external speaker with an audio cable just as is shown on the simulator.

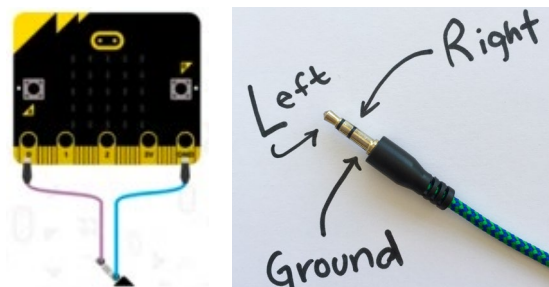
## DEMONSTRATE AND HAVE MAKERS FOLLOW ALONG:



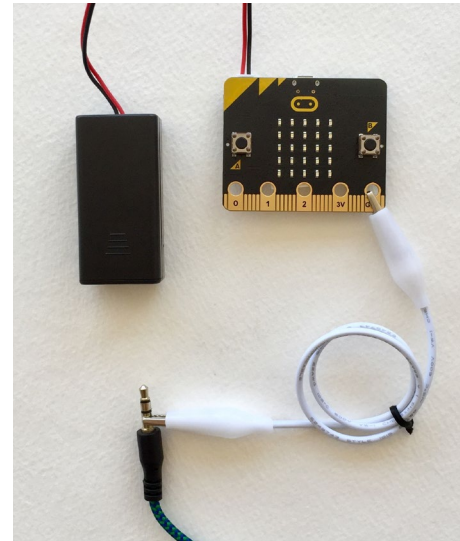
1. Notice that in the simulator there's an image of an audio cable connected to **Pin 0** and **GND**. This is the same type of cord you might find on your headphones or a speaker at home.



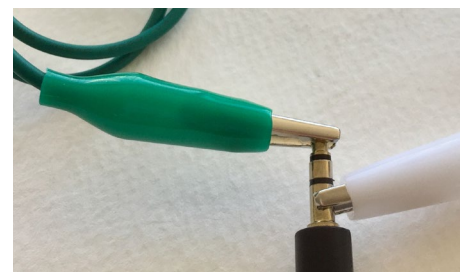
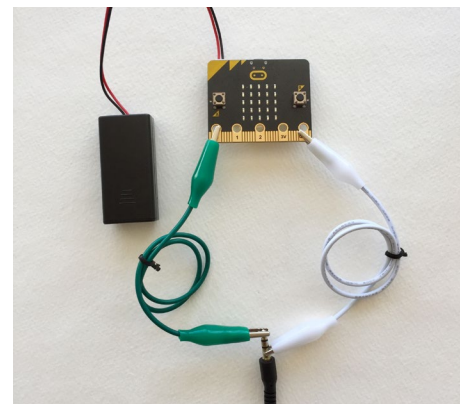
2. If you look closely at the cord from the speaker, you'll see 2 black stripes on the tip of the cable. On this audio plug, the bottom row is ground, and the middle and top of the cable are right and left audio.



3. The bottom row is ground, so that will connect to **GND** on the Micro:bit. Connect an alligator clip from **GND** on the board to the lower section of the 1/8" plug (ground).



4. Next, connect an alligator clip from **Pin 0** on the board to the top section of the 1/8" plug (left audio).

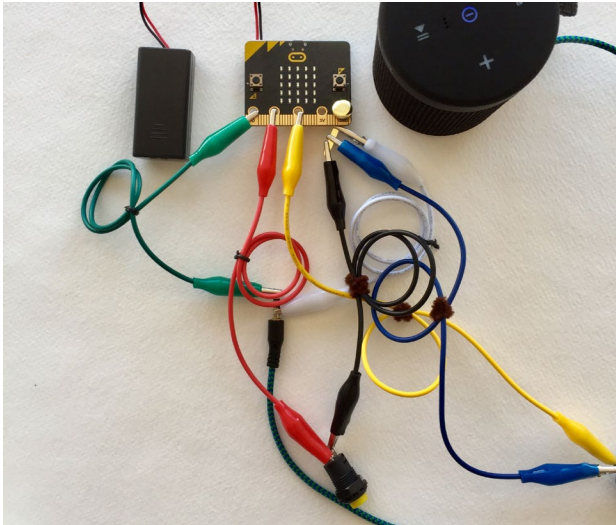


Now, test the sound again by pressing the buttons. You should hear sounds through the speaker!

## STEP 5



### Remix code and add switches and buttons.



Once makers have successfully connected the speaker in Step 3 and can control the sounds with the buttons, they can explore remixing the code. With the remaining time, they should connect the Micro:bit to the computer and explore remixing the code or creating new MakeCode projects.



## STEP 6



### Clean up.

Makers will:

- Make sure to save their files with a unique name.
- Safely disconnect the Micro:bit from the computer.
- Safely disconnect alligator clips from the Micro:bit.
- Put materials away in their bins.
- Put technology away and make sure laptops are charging.
- Return tools and materials that can be used again to the right place.
- Clear tables of garbage and recycling.

## TROUBLESHOOTING TIPS

**The board isn't showing what we coded.**

### File version check

- Check to see that you've uploaded the most recent copy of the code.
- Resave the latest version and drag and drop onto the Micro:bit.

**The code isn't doing what we expected.**

### Check for bugs

- Read through the code.
- Read it out to a friend.
- Check to see if there are extra blocks that aren't supposed to be there.

**The LED on the Micro:bit is not flashing when we click Upload.**

### Bad cable or port

- If the Micro:bit isn't showing up in the computer menu, try a different cable.
- Try a different USB port on the laptop.

**Our code isn't uploading correctly to the board. The board feels hotter than usual.**

### Burnt board

- Try pressing the reset button on the board.
- Try uploading to a new Micro:bit board.

**The board isn't turning on when connected to the battery pack.**

### Battery

- Check the batteries to see if they're charged.
- Check to see if the batteries are flipped.

**We have alligator clips connected to the board, but the code isn't running.**

### Alligator clips

- Make sure alligator clips are secure on the correct pins and are touching the metallic parts.
- Try switching alligator clips.

**It's hard to keep the connections in place.**

### Alligator clips

- Use painter's tape to hold alligator clips in place.
- Try using foil to extend the metal parts of the board.



## TROUBLESHOOTING TIPS

*Print and use the empty rows to fill in with other problems and solutions that can be shared.*

[illegible]