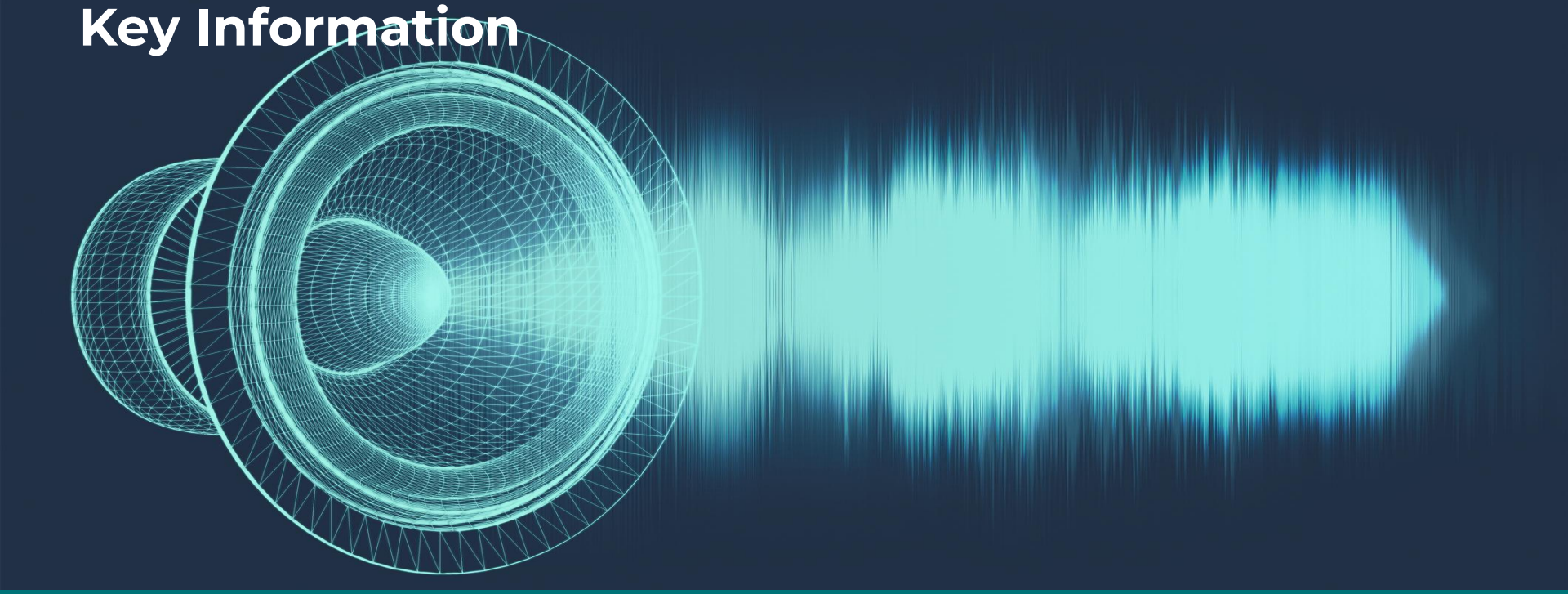
Sound Level Stoplight

Exemplar Lesson

Learn

Key Information

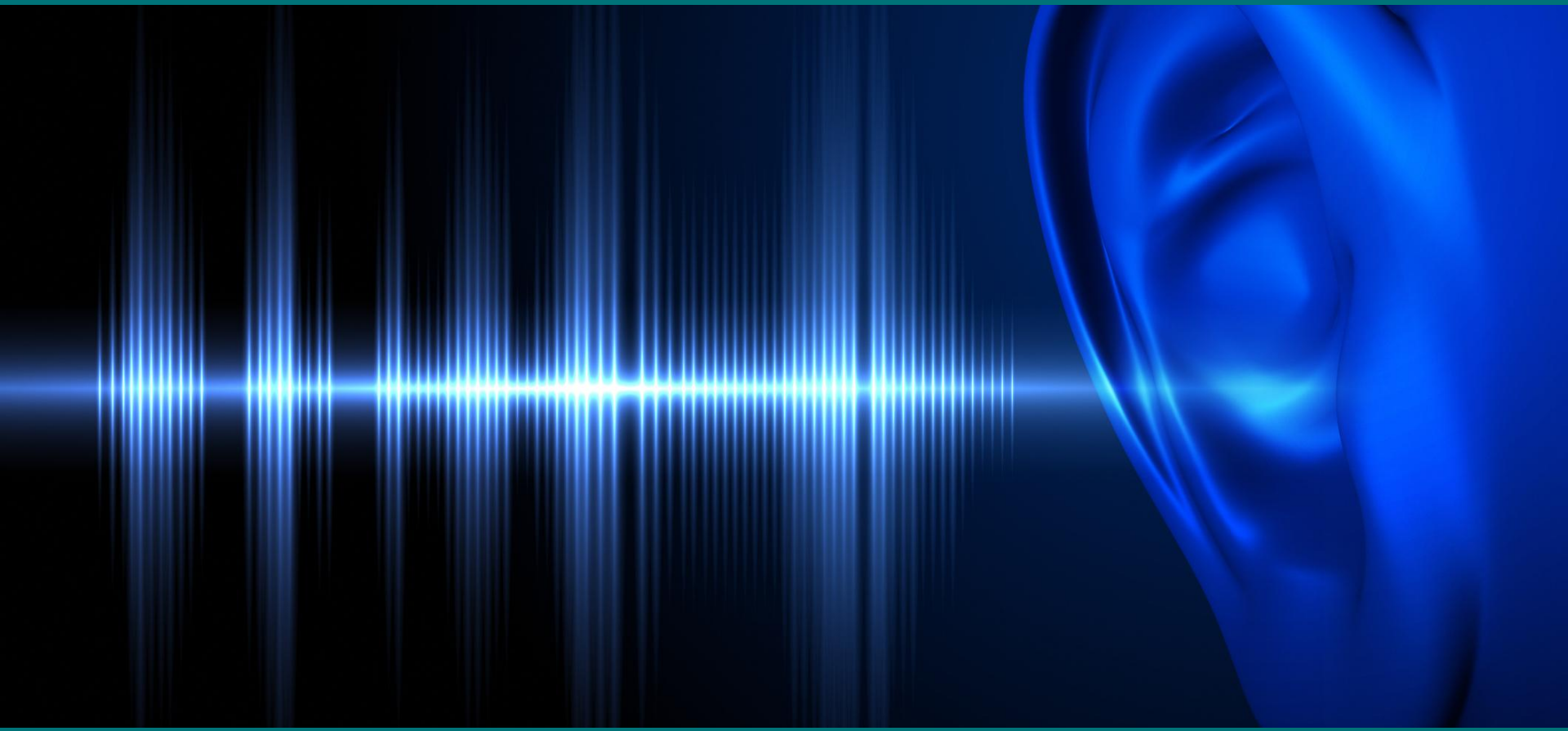


How does sound work?

- Sound is a mechanical wave, a back-and-forth motion of air molecules
- Sound waves have characteristics that affect how we perceive the sound:
    - **Wave amplitude** is related to how loud the sound is
    - **Wave frequency** is related to the pitch of the sound

Unplugged Activity

What is the loudest sound you have ever heard? What is the quietest?



Unplugged Activity

When do people wear ear protection?

What is it about those situations that make ear protection necessary?

Unplugged Activity

Complete a KWL chart to record your knowledge

KWL Chart

Name _____

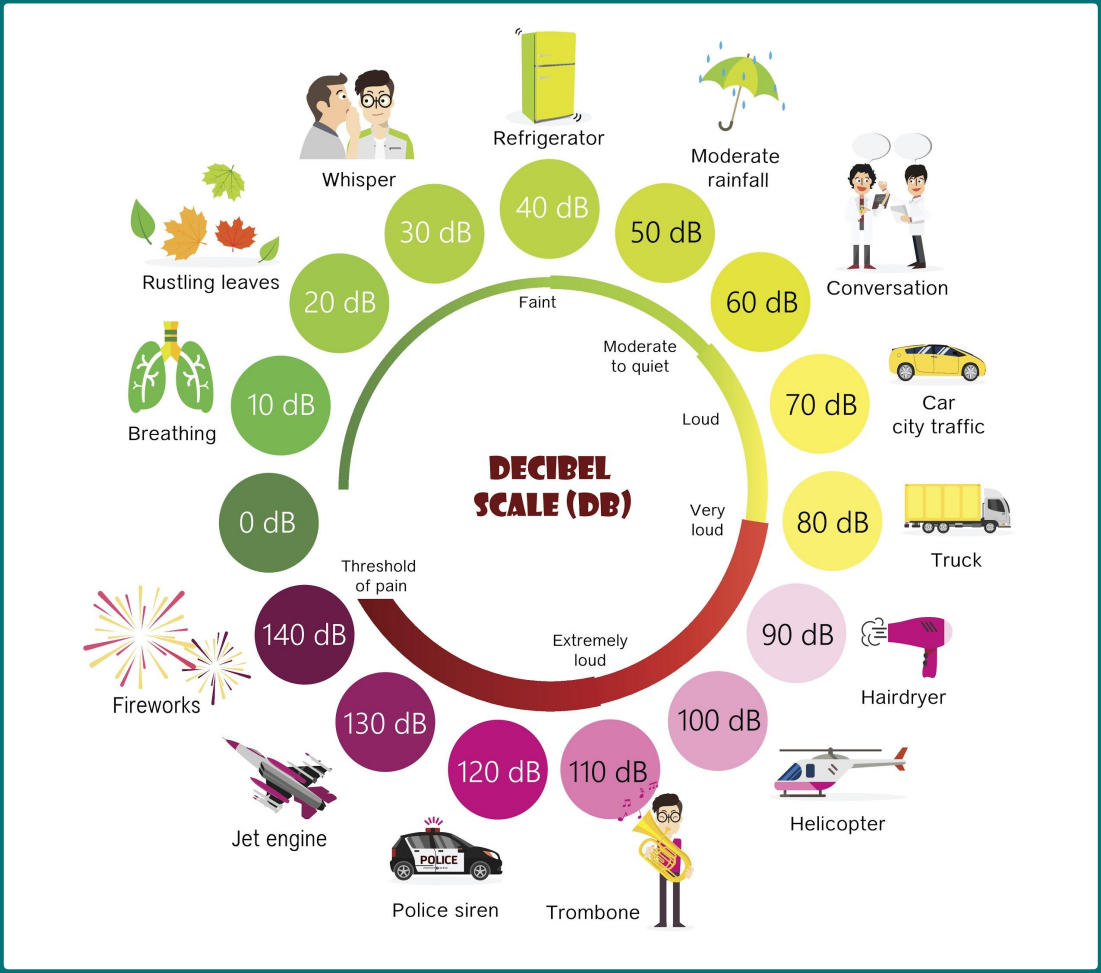
Date _____

Topic: _____

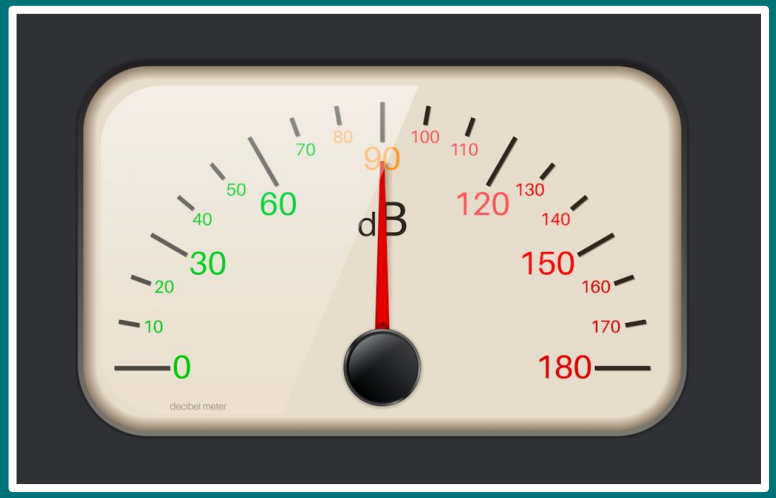
Know	Wonder	Learned
What do you think you already know about this topic?	What do you wonder about this topic? Write your questions below.	After you complete your project, write what you learned.

Key Information

How loud is that? Explore the decibel scale.



Key Information



- The loudness of sound waves is measured in decibels (dB).
- The **decibel scale** is based on human hearing:
    - 0 dB is the “threshold of hearing”. Sounds quiet enough to be 0 dB are just at the limits of our ability to hear.
    - 130 dB is the “threshold of pain.” 130 dB sounds waves are powerful enough to permanently damage human ears.

Unplugged Activity

Explore Sound Levels

Create a sorted list of sounds, organized from quietest to loudest. List the dB measurement and describe the situation that created that dB measurement.

- Where?
- What was creating the sound?
- How far were you from it?
- How consistent was the measurement?

How many decibels is “loud”? “Quiet”?

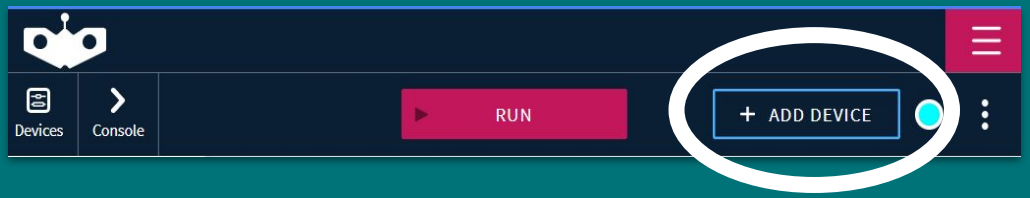
Do

Guided Lab - Part 1

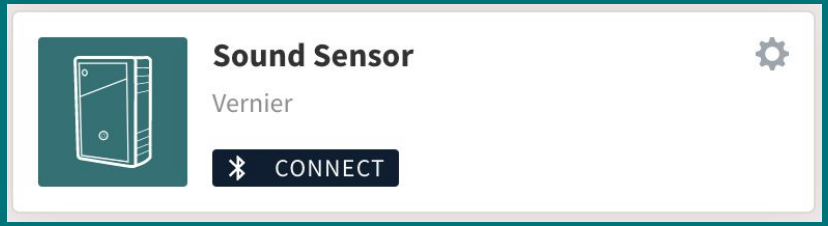
Guided Lab - Part 1

Design and code a program that measures various sound levels

A Go to https://edu.workbencheducation.com/

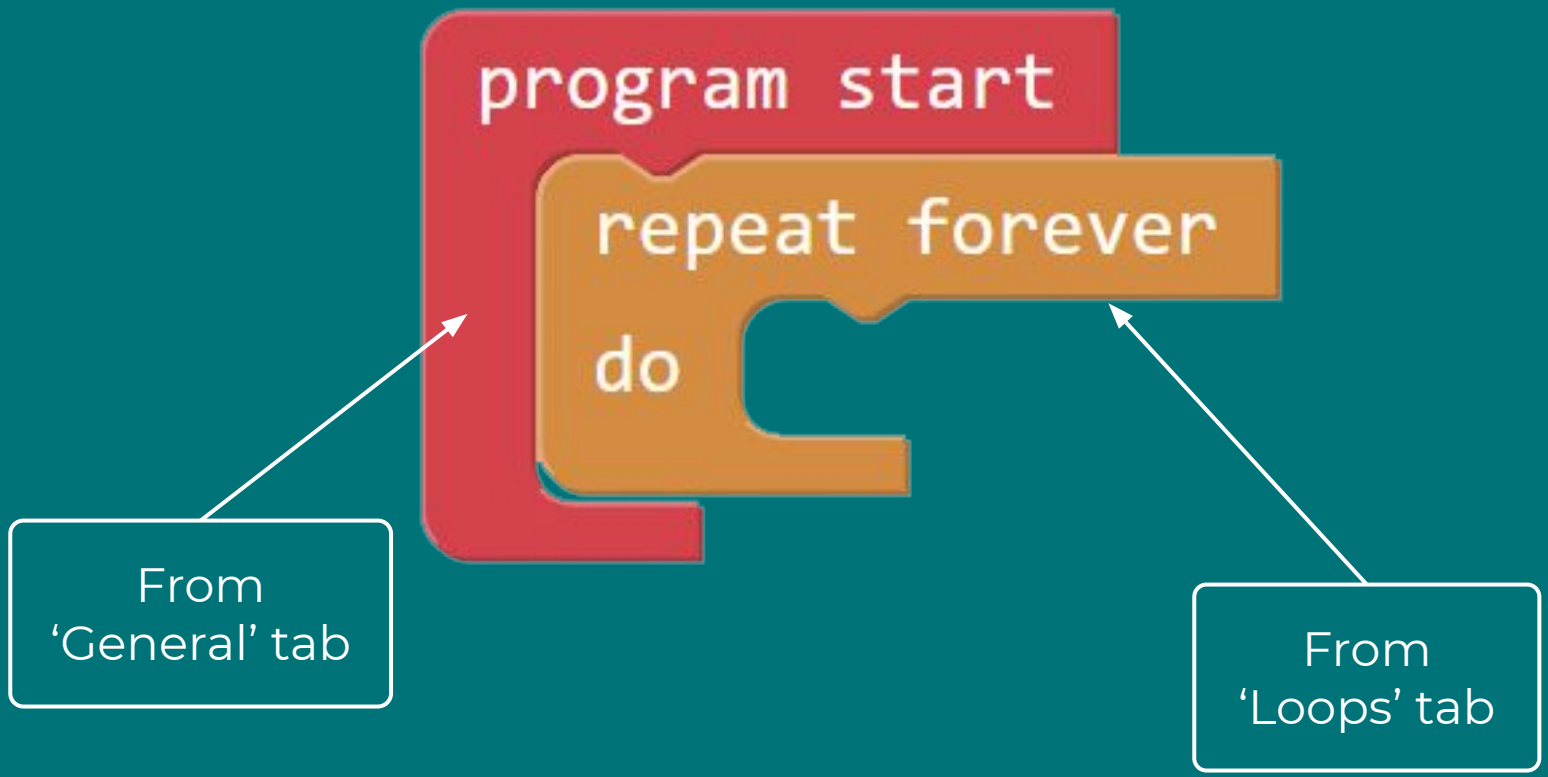


B On the Workspace click ‘ADD DEVICE’ and select: ‘Sound Sensor’

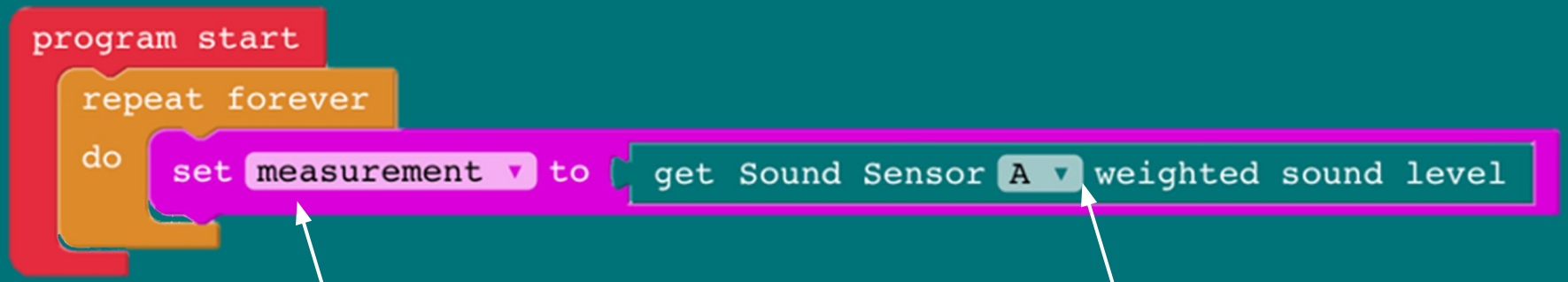


C Connect the Sound Sensor, click ‘CONNECT’ and ‘Pair’.

Guided Lab - Part 1



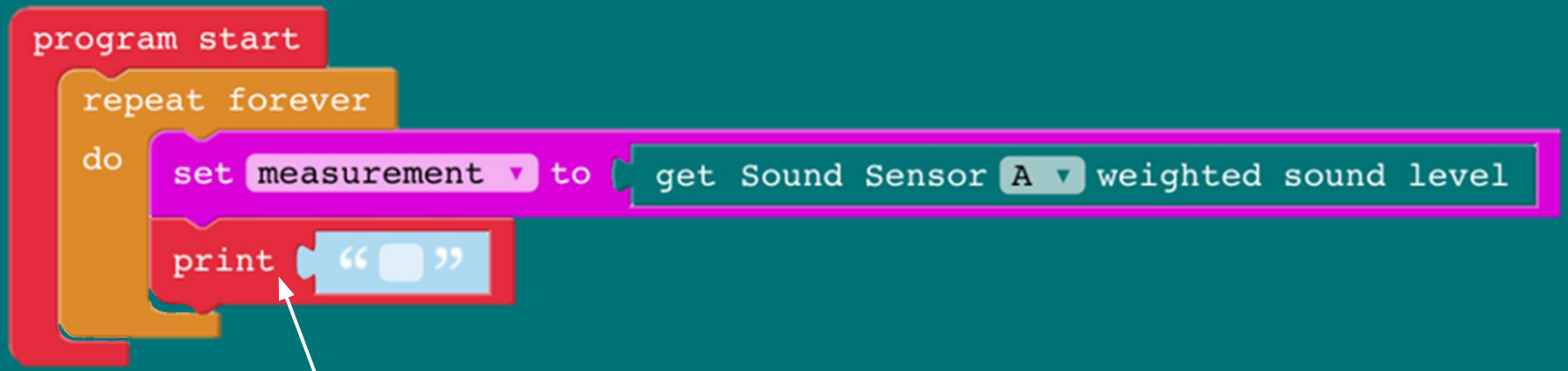
Guided Lab - Part 1



From ‘Variables’ tab
Create ‘measurement’ variable

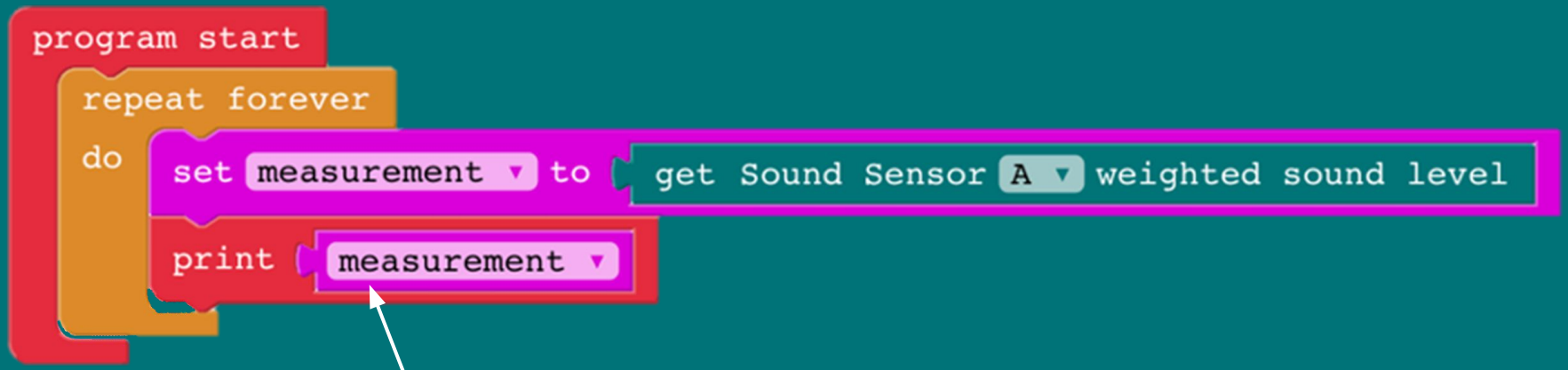
From
‘Sound Sensor’ tab

Guided Lab - Part 1



From ‘General’ tab

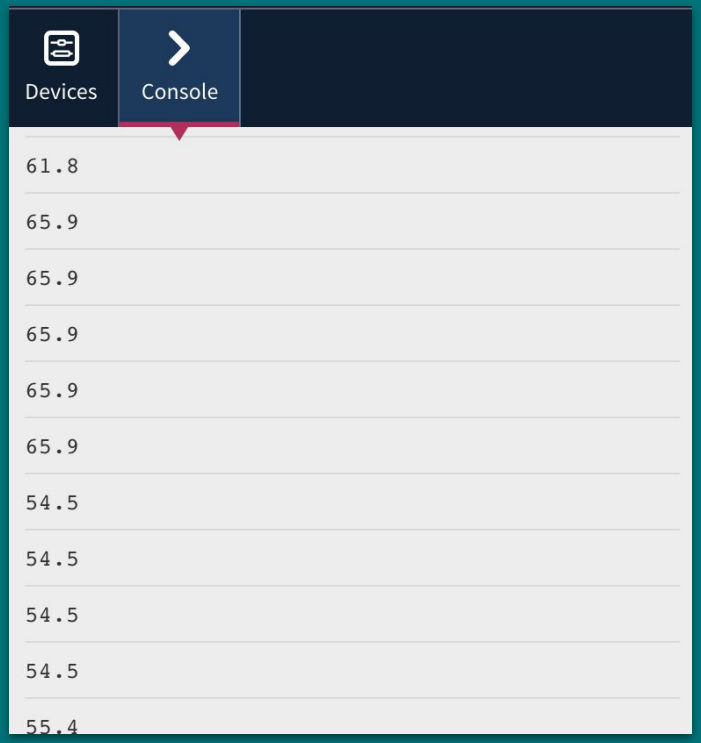
Guided Lab - Part 1



From 'Variables' tab

Run your program

What variety of results do you get?

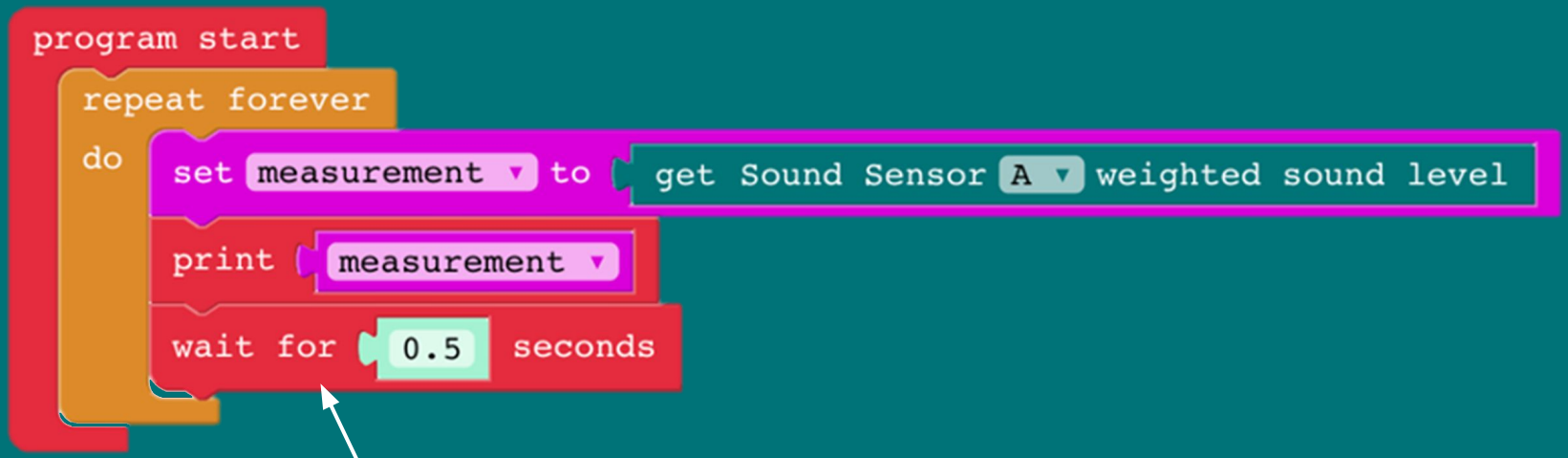


Debug

How can I slow down the readings to better understand the data?

Debug Opportunity

How can I slow down the readings to better understand the data?

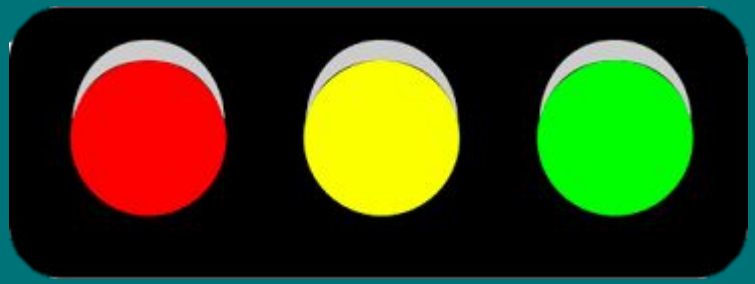


From ‘General’ tab

Do

Guided Lab - Part 2

Guided Lab - Part 2



How loud is too loud? For your stop light to give good feedback, you need to decide what sound level is acceptable (green light), getting too loud (yellow light), and definitely too loud (red light).

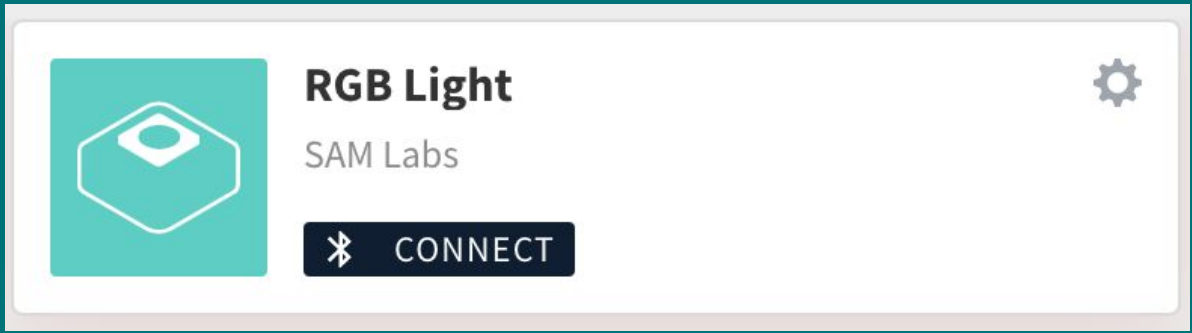
1. Use the program you made to collect a variety of sound levels.
2. With the Sound Sensor at arms length, try talking quietly, in a normal volume, and loudly. How loud, in decibels, did the Sound Sensor record?
3. Determine what range sound levels are acceptable (green), borderline (yellow), and unacceptable (red).

Guided Lab - Part 2

Use your program to investigate sound levels and visually represent the different levels through a stoplight.

From ‘Logic’ tab

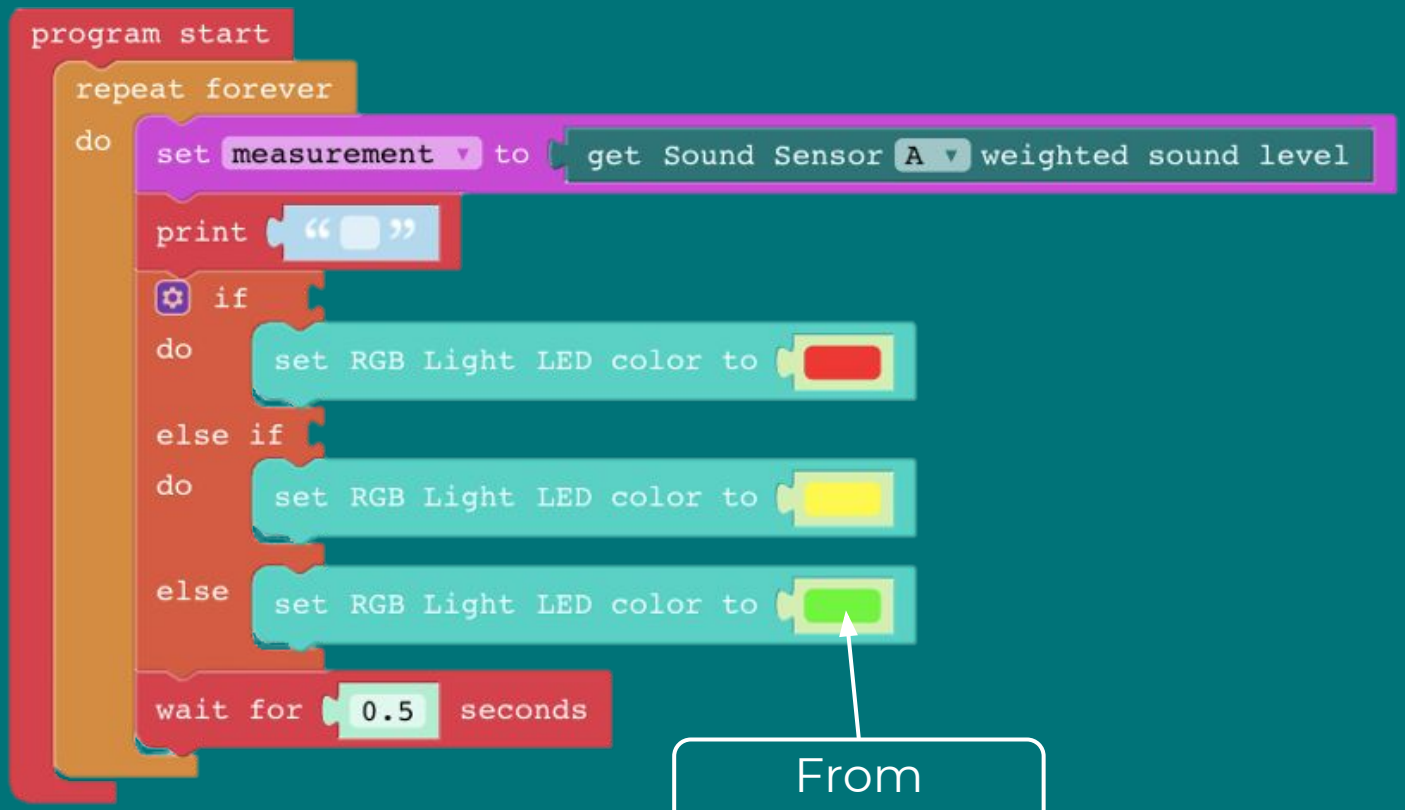
Guided Lab - Part 2



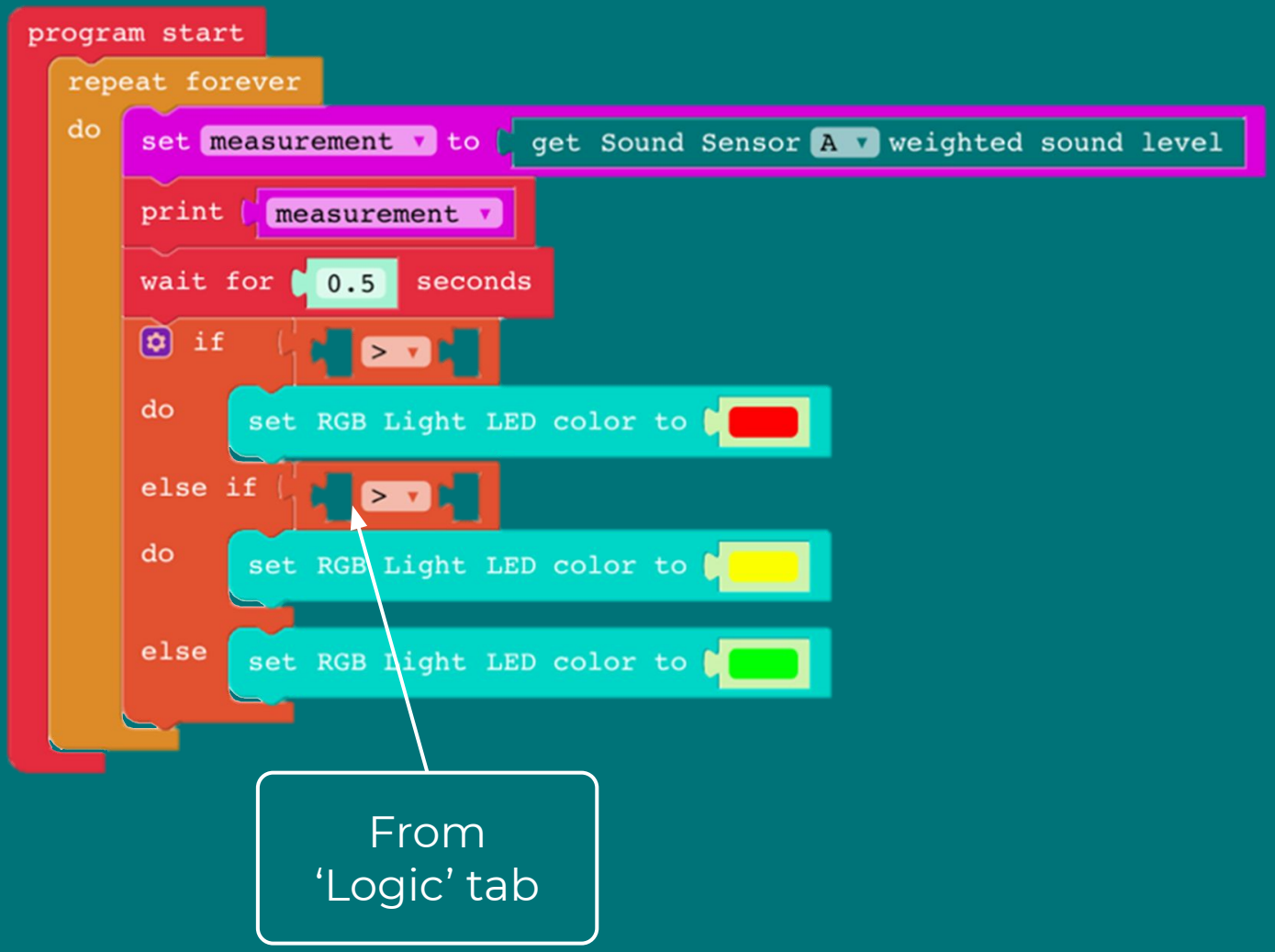
Click Add Device
Select RGB Light

Connect the RGB Light, click ‘CONNECT’ and ‘Pair’.

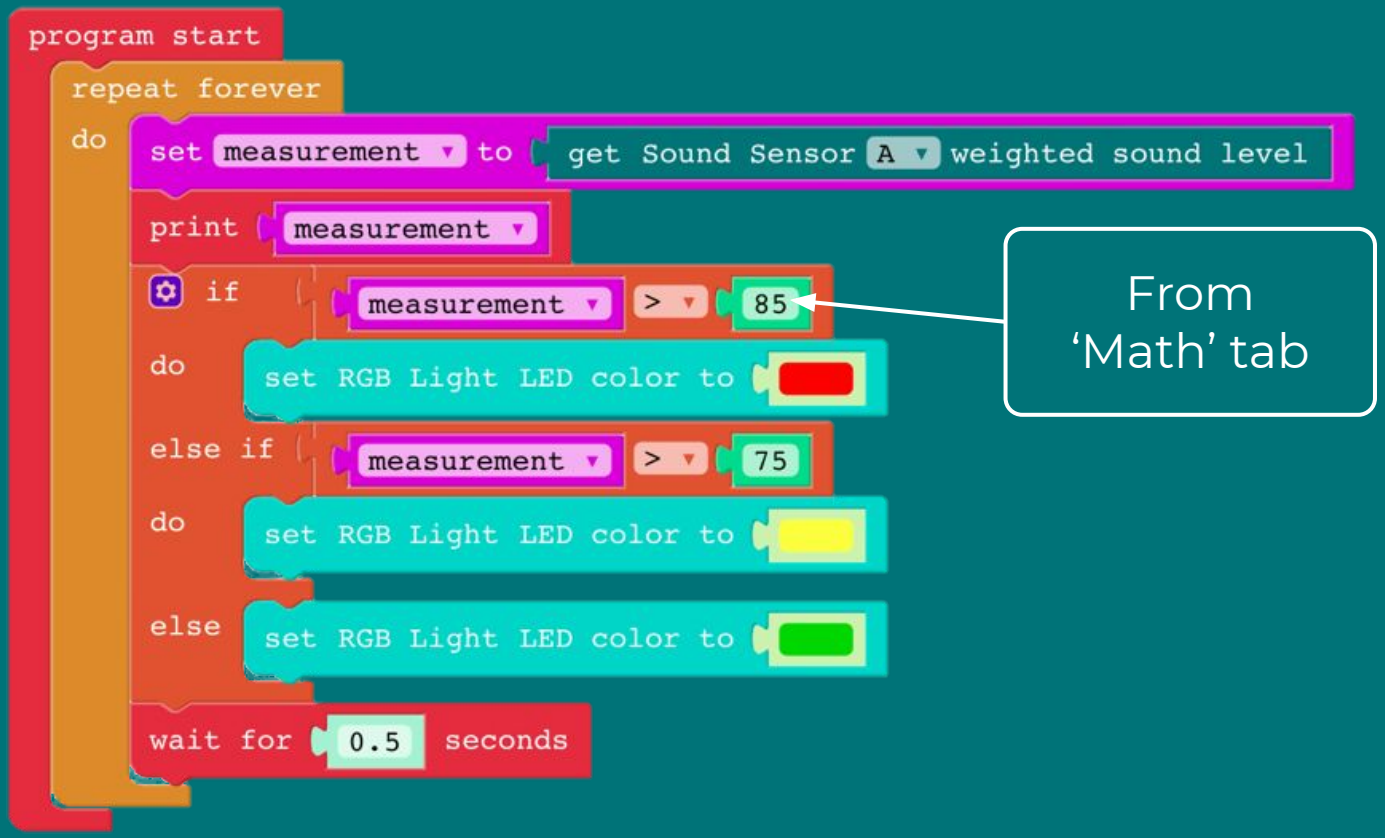
Guided Lab - Part 2



Guided Lab - Part 2



Guided Lab - Part 2



Guided Lab - Part 2

Run your program

1. Does the LED light change color when it is programmed to?
2. Are sound level ranges appropriate? Or do they need some tweaking?
3. Where should you place the Sound Sensor to get accurate readings of the sound levels in the room?
4. Are the sound level ranges appropriate with the Sound Sensor in this new location?
5. Can everyone see the RGB Light and tell what color it is? If not, where should it best be placed?

Extension Activities

Design Brief 1
Google Sheets

Record sound level data to a Google Sheet. Collect sound data in various rooms or periods throughout the day. Analyze how and why sound levels changed throughout the day.

Design Brief 2
Buzzer

Trigger a Buzzer block as additional feedback when the room's sound level grows too large. Encourage students to discuss a reasonable wave amplitude and frequency for the buzzer sound.

Design Brief 3
Prototype

Using classroom materials or 3-D printed materials, 3 RGB LEDs, and the Sound Sensor, design a Sound Level stoplight prototype for daily use.

Reflect

Exit Tickets

What factors affect how loud a sound will be measured by the Sound Sensor?

Do you think your sound level stop light would work well in a classroom setting? Why or why not?