



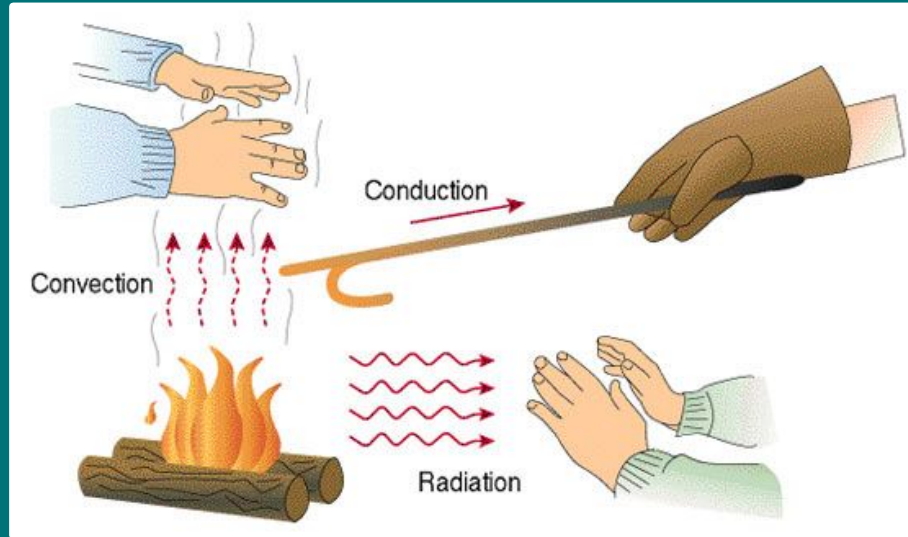
# Temperature

Exemplar Lesson

# Learn

# Key Information

## How do things get hot?



- Temperature is a measure of average kinetic energy of molecules in a substance
- Heat is the movement of energy through
  - Conduction
  - Convection
  - Radiation
- Substances differ in how fast they transfer heat
- Heat moves from hot to cold

## Where do you see heat transfer in the world around you?





# Unplugged

## What materials transfer heat quickly or slowly?



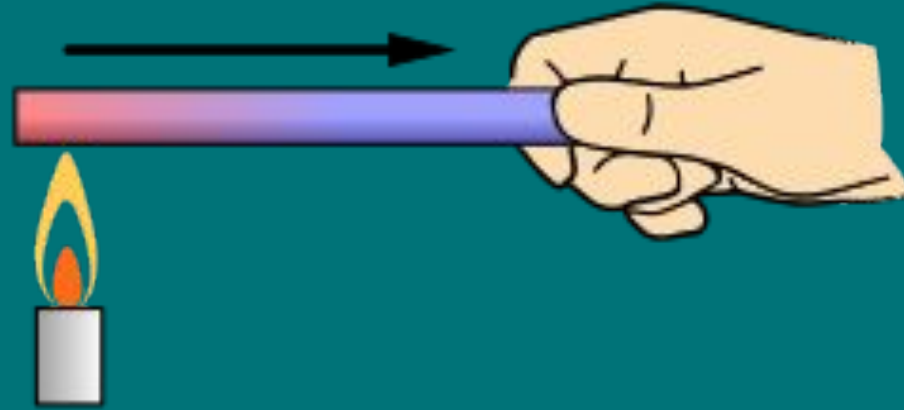
# Unplugged Activity

## Complete a KWL chart to record your knowledge

<b>KWL Chart</b>		
Name _____		
Date _____		
Topic: _____		
<b>Know</b> What do you think you already know about this topic?	<b>Wonder</b> What do you wonder about this topic? Write your questions below.	<b>Learned</b> After you complete your project, write what you learned.

# Key Information

## How does conduction work?



- As the motion of atoms and molecules speeds up, the temperature of the substance increases.
- In conduction, faster-moving molecules collide with slower-moving molecules and transfer energy to them.
  - The fast molecules slow down (cool).
  - The slow molecules speed up (heat).
- Energy is transferred from a substance at a higher temperature to a substance at a lower temperature.

# Unplugged Activity

## Conductors vs. Insulators

### Conductors

- Transfer heat quickly from hot to cold
- Atoms or molecules are close together



### Insulators

- Materials or substances that do not readily allow the passage of heat



What are some examples of conductors and insulators around you?



# Unplugged Activity

## Converting Temperature from Fahrenheit to Celsius



What temperature (in Celsius) is effective when washing your hands?



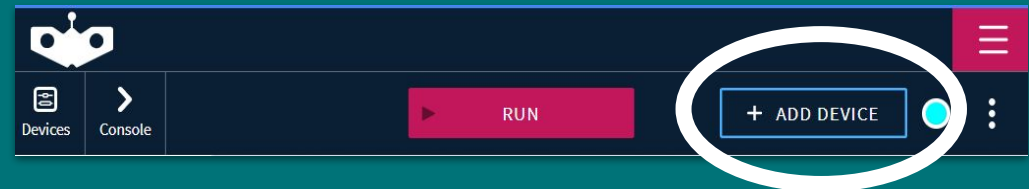
What temperature (in Celsius) is good for drinking a hot chocolate?

# Do

Guided Lab - Part 1

**Students code a program to measure the temperature and turn on an LED to indicate a temperature range.**

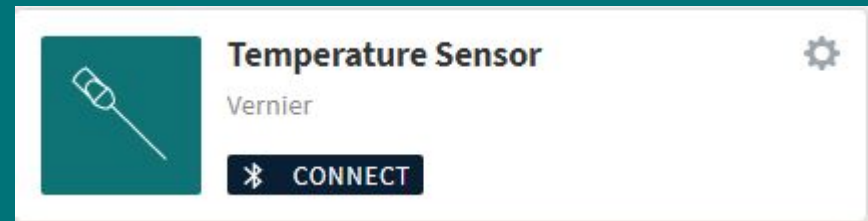
**A** Go to <https://edu.workbencheducation.com/>



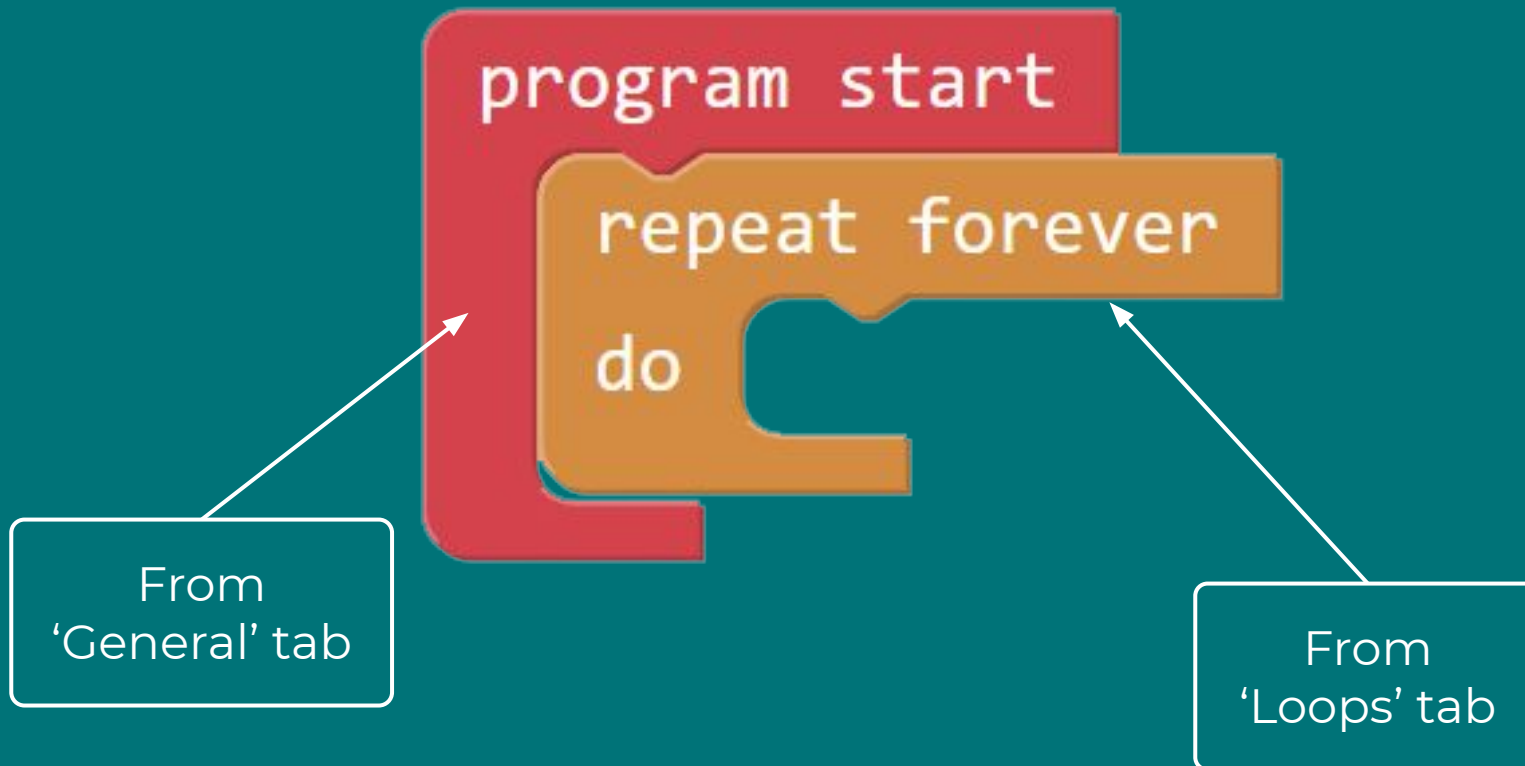
**B** On the Workspace click 'ADD DEVICE' and select: 'Temperature Sensor'

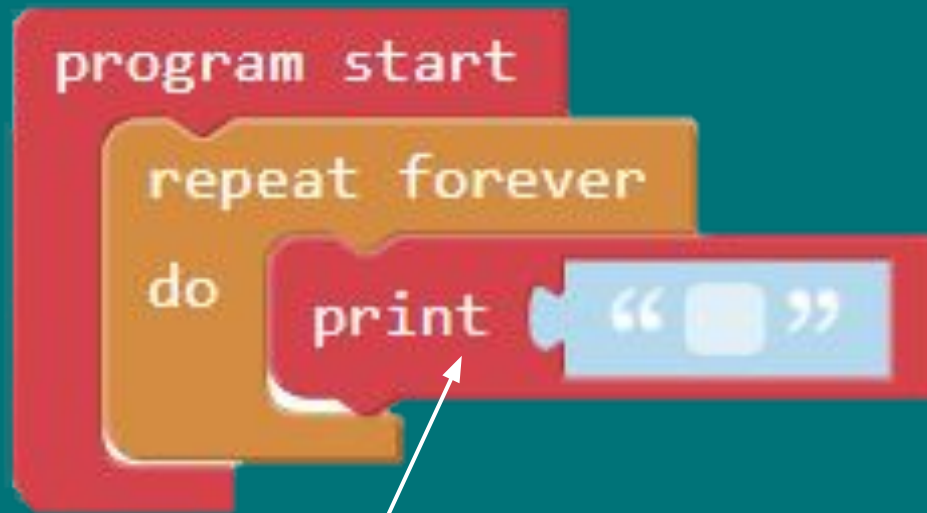


**C** Connect the sensor, click 'CONNECT' and 'Pair'.



# Guided Lab - Part 1





From 'General' tab





From  
'Temperature  
Sensor' tab

# Run your program

Measure different objects around the room. What do you observe?



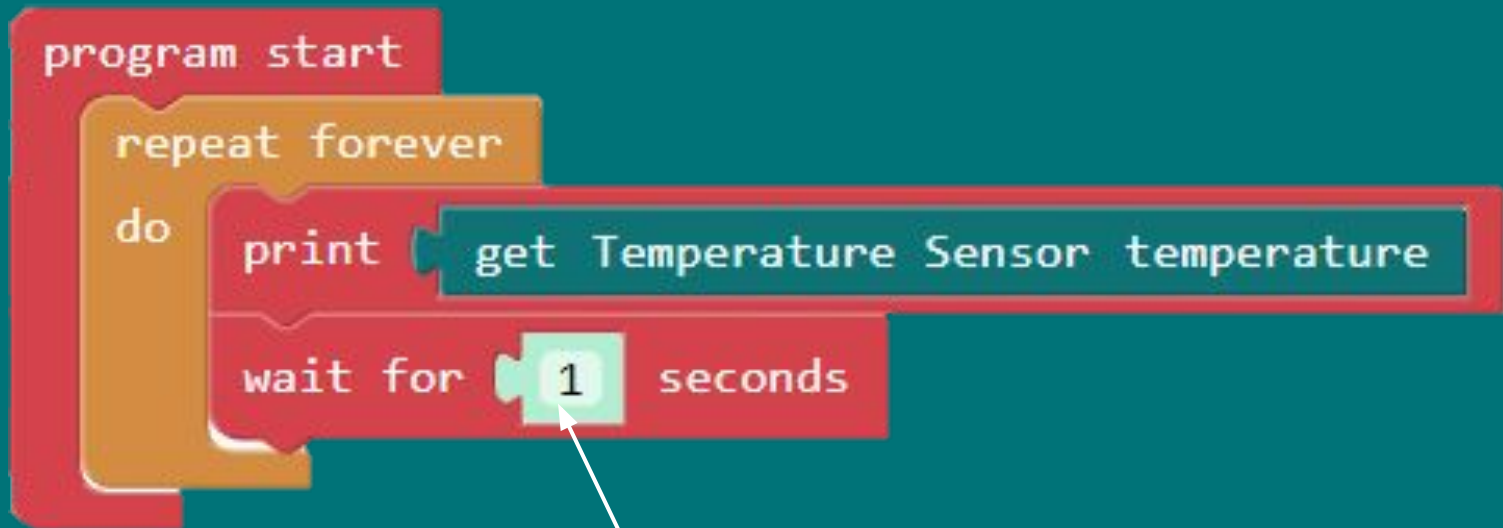
Temperature Sensor collects temperature data in Celsius.

# Debug

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

# Debug Opportunity

What wait time is most appropriate for the code?



From  
'General' tab

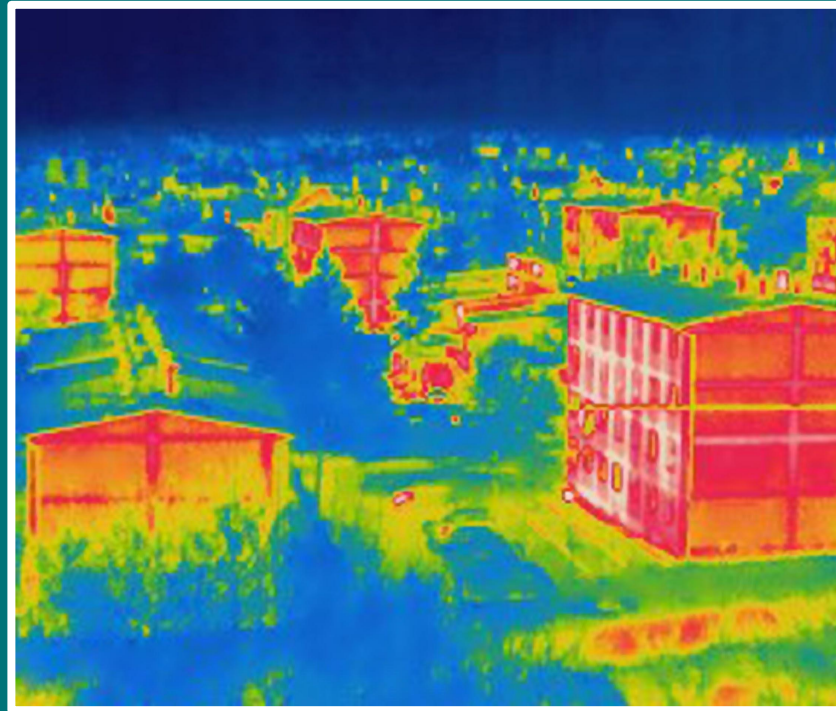
# Do

Guided Lab - Part 2

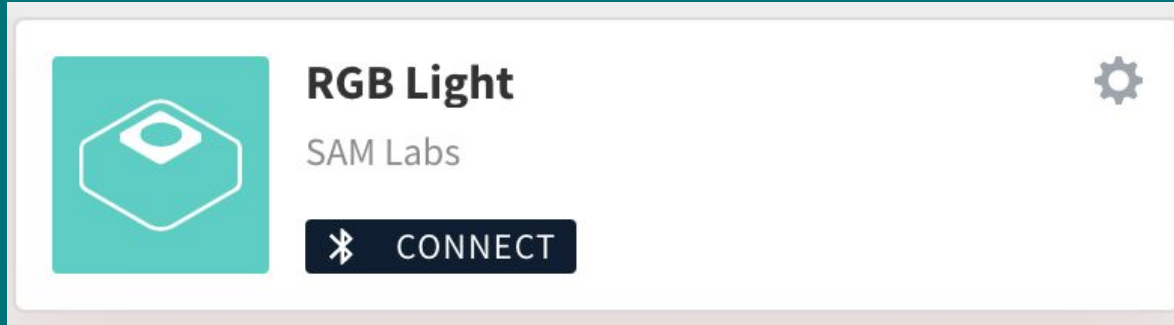


## Guided Lab - Part 2

**Design and code a program that changes the color of an LED based on the temperature**



What colors do you associate with various temperatures?



Click Add Device  
Select RGB Light

Connect the RGB Light, click  
'CONNECT' and 'Pair'.

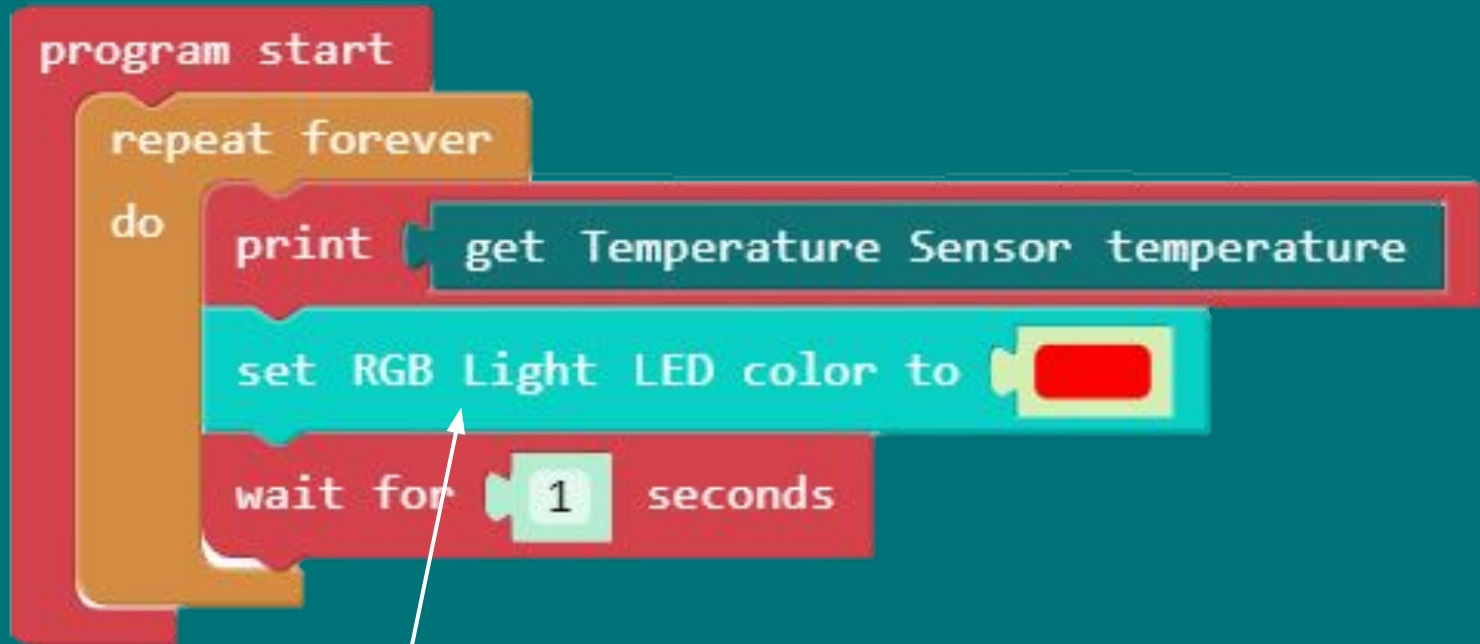
# Guided Lab - Part 2

1

2

3

4



From 'RGB Light'  
tab

# Guided Lab - Part 2

1

2

3

4



Click to choose color

# Guided Lab - Part 2

1

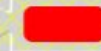
2

3

4

Unsnap LED blocks

set RGB Light LED color to



set RGB Light LED color to



From 'Logic' tab

program start

repeat forever

do

print

get Temperature Sensor temperature

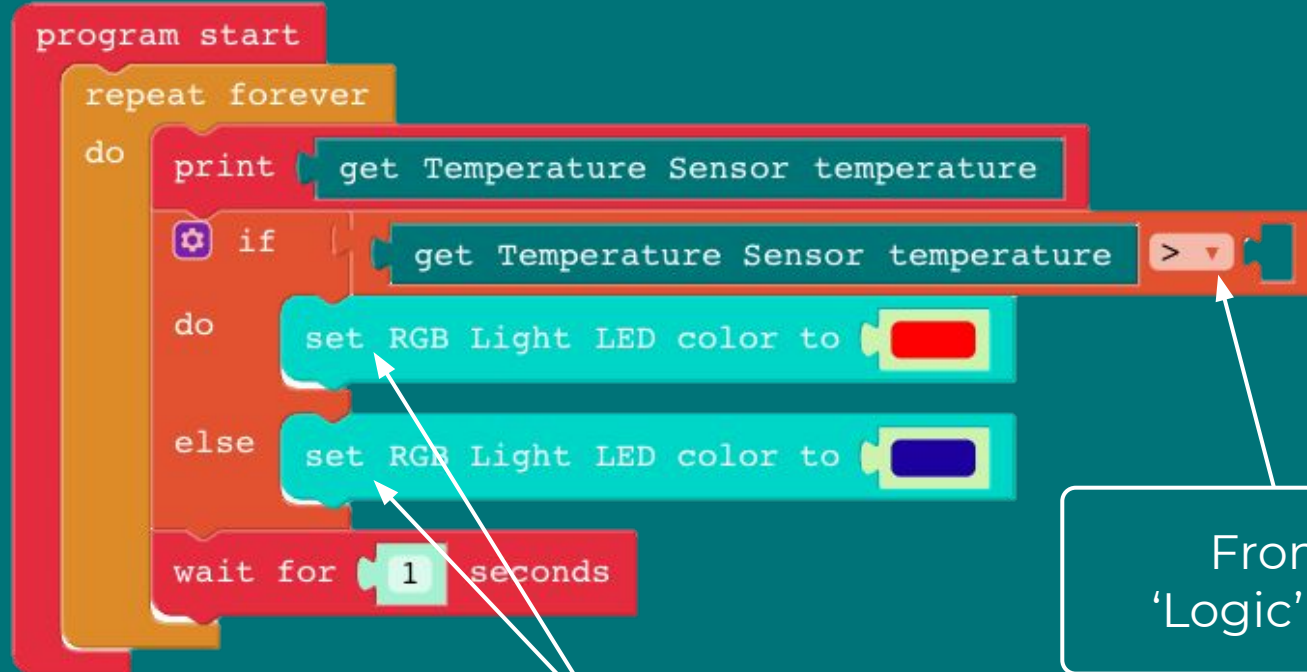
if

do

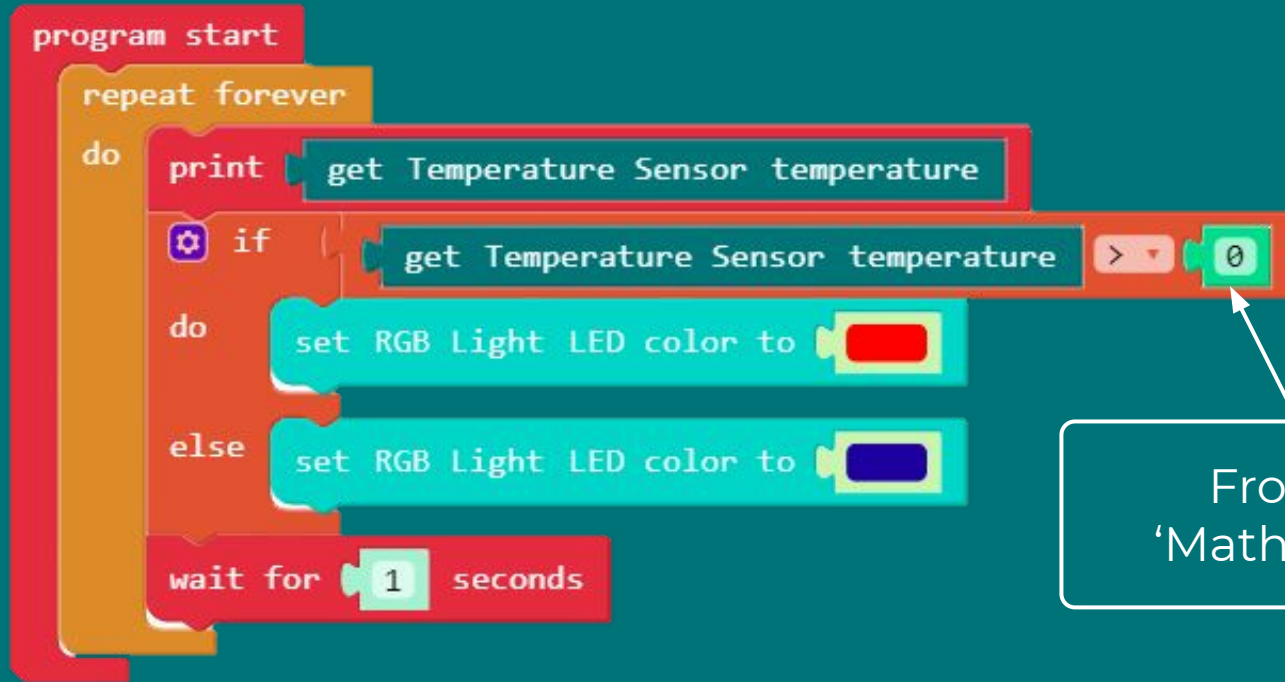
else

wait for 1 seconds





Snap red LED block into the "do" and the blue LED block into the "else" position.

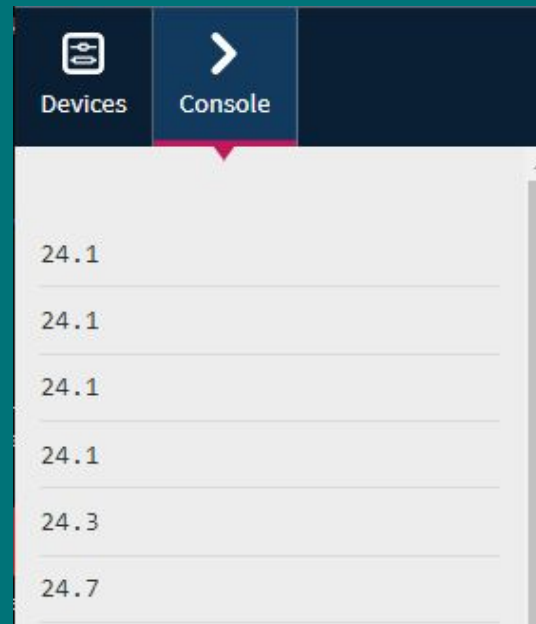


From  
'Math' tab

Change "0" to temperature  
above room temp.

## Run your program

What variety of results  
do you get?



Can you find various items that give you 'blue' and 'red' temperature readings?

# Extension Activities

## Design Brief 1

Fahrenheit

Modify your code so that temperature readings are displayed in Fahrenheit instead of Celsius.

## Design Brief 2

Three Temperature Ranges

Include a temperature range so that the optimum hand washing temperature makes the LED turn green.

## Design Brief 3

Blinking Red LED

Modify your code so that the red LED blinks on and off when the temperature is above the limit you set.

# Reflect



# Exit Tickets



How does the sensor help to demonstrate temperature more effectively than touch?

Why do you think some objects feel colder than others even though they are the same temperature?

Explain why rubbing your hands together makes them warmer.