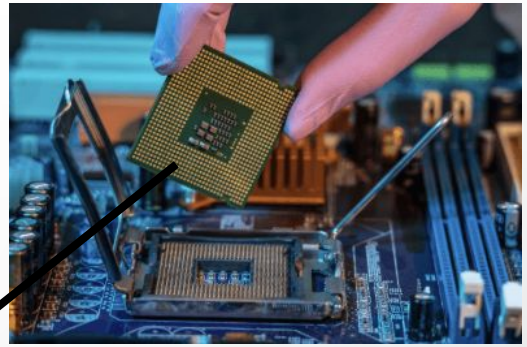
FROM CIRCUITS TO MICRO:BITS

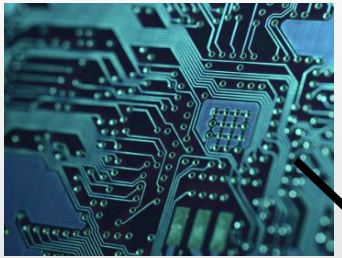
AN INTRODUCTION
TO
MICROELECTRONICS

What will we learn today?

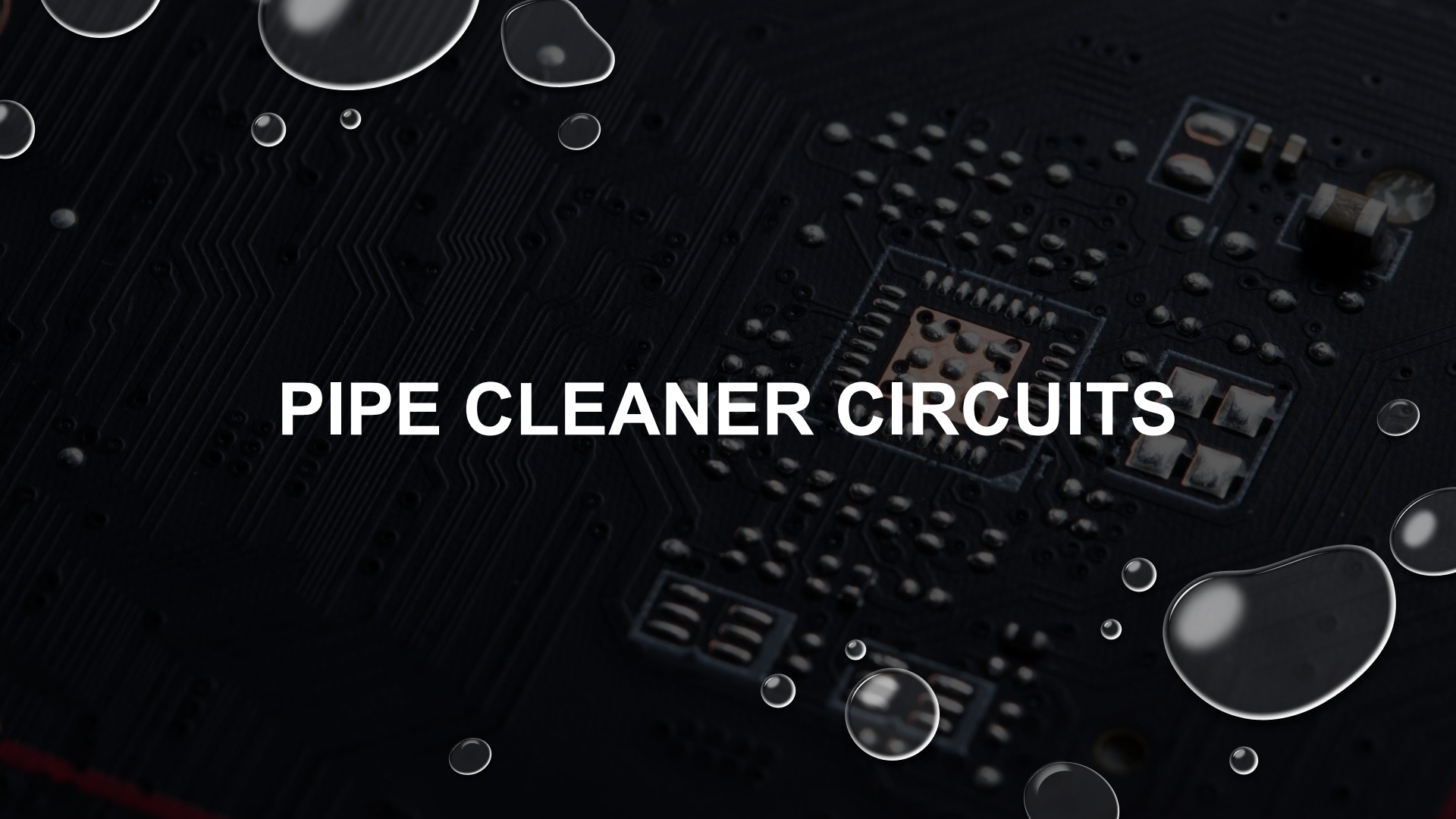
Microelectronics are the brains of electronic devices. These super tiny parts include circuits.

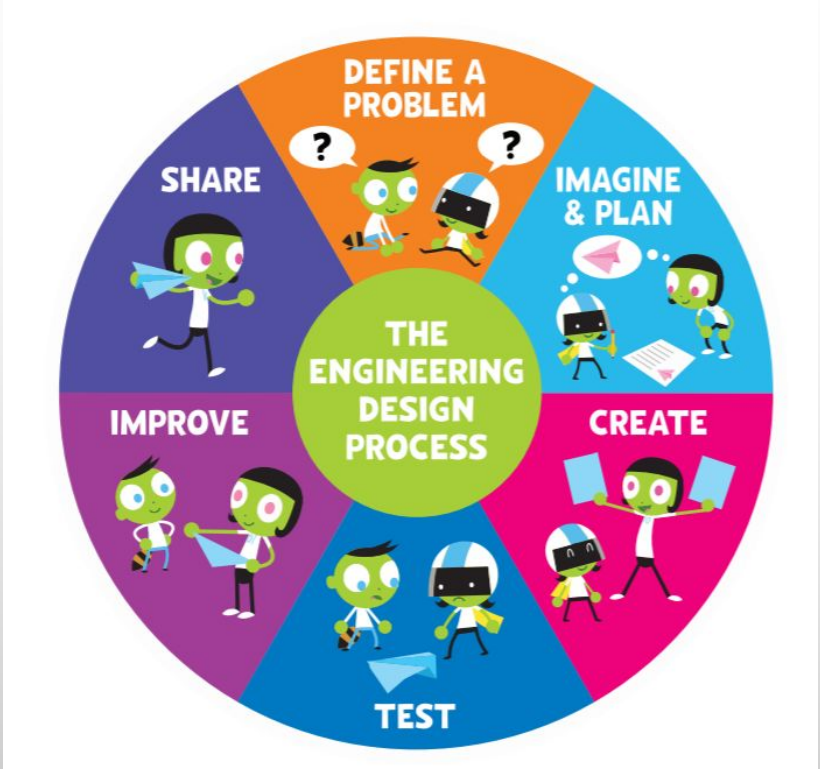


*A **circuit*** is a path that electrons travels.



Micro:bit is a small computer that includes a full of microelectronics and circuits connecting everything.


PIPE CLEANER CIRCUITS


DEFINE A PROBLEM
IMAGINE & PLAN
CREATE
TEST
IMPROVE
SHARE
THE ENGINEERING DESIGN PROCESS

CLIENT LETTER

Define

To: Student Engineers

From: Brightwear Co., Design Team

Re: Challenge Response to New Accessory

Dear Student Engineers!

We need your help! Our company, Brightwear Co., wants to make a brand new accessory that lights up. People love items that glow because they're fun to wear and help keep them safe in the dark.

Your job is to create a light-up accessory using the materials you're given. It could be a bracelet, a badge, a backpack clip, a key chain, a light-up animal, or anything else you imagine. It doesn't have to be perfect — we just want to see your creative ideas and how you make the light turn on.

We know you'll do an amazing job, and we can't wait to see what you design.

Thank you for being part of our team.

Sincerely,

Alex Rivera

Learn

ELECTRONICS BACKGROUND

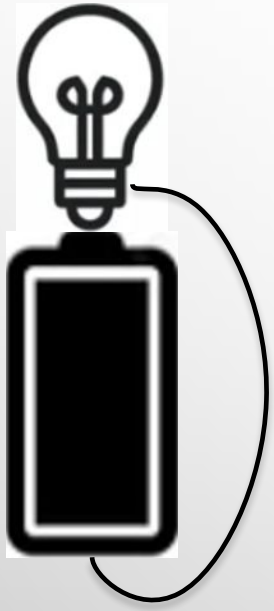
- How an electric current works
- The roles of conductors and insulators
- Series and parallel circuits

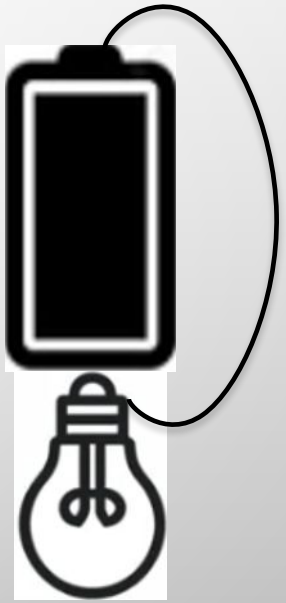
Learn

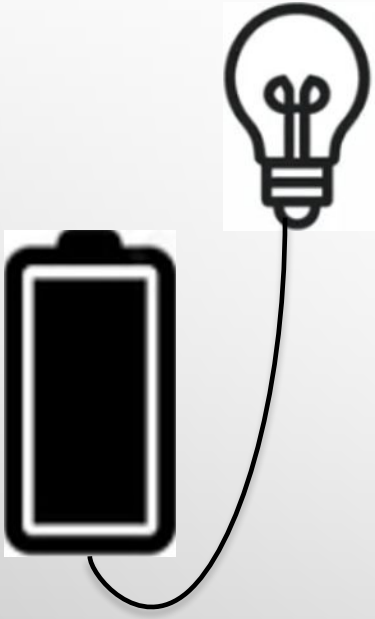
Imagine

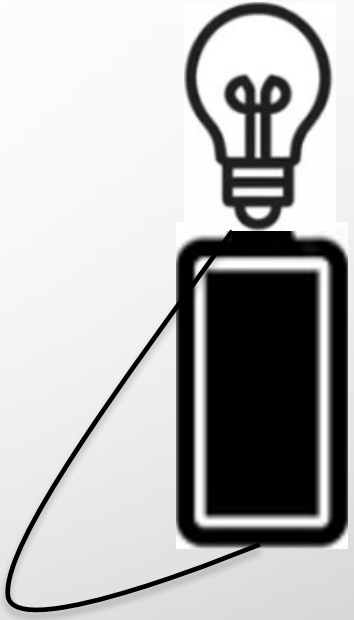
LIGHT THE BULB!

- How to light a bulb using a battery and a wire





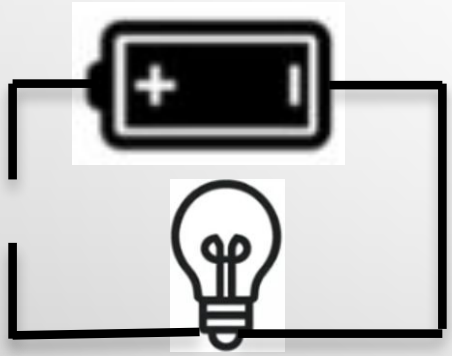




Learn

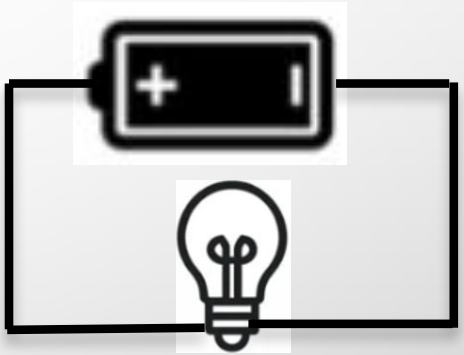
Imagine

OPEN CIRCUIT VS CLOSED CIRCUIT



Open

VS



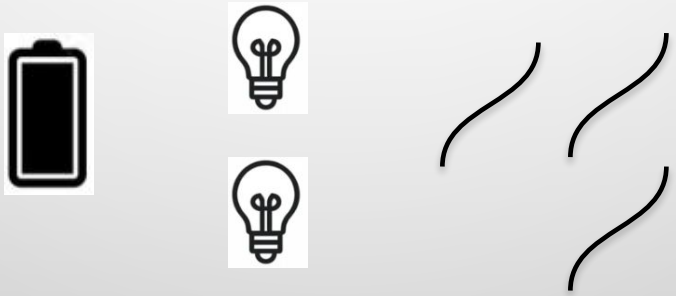
Closed

Learn

Imagine

LIGHT THE BULBS!

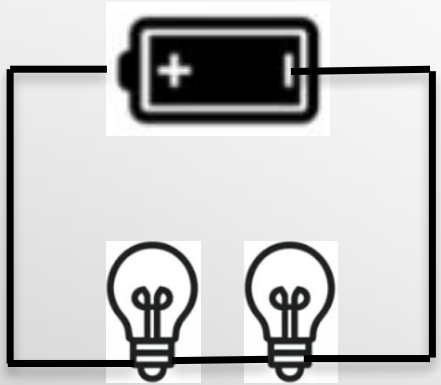
- How to light TWO light bulbs using a battery and 3 wires



Imagine

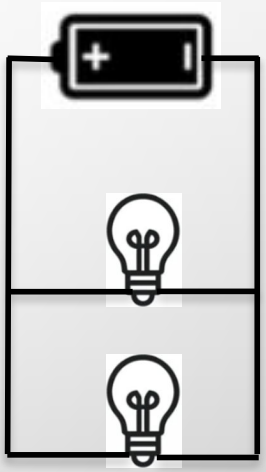
Learn

MANY BATTERIES AND MANY BULBS



- Series circuit
  - Electricity follows **one single path**
  - If one-part breaks, the whole circuit stops working

In our project , we'll mostly use simple series circuits!



- Parallel circuit
  - Electricity has more than one path
  - If one-part stops working, the others can still stay on

Learn

Imagine

CIRCUIT MATERIALS

To make electricity flow, we need special types of materials.

Conductors: materials that let electrons move through them (often metals)

Insulators: materials that stop electrons from flowing

Plan

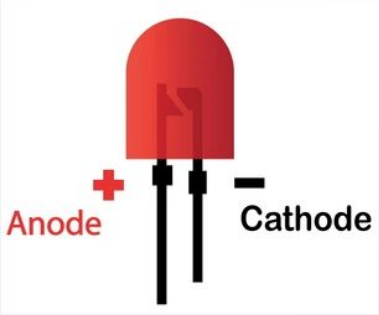
MATERIALS LIST

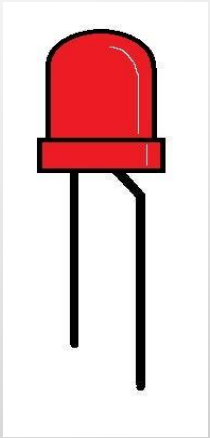
- LED bulb
- Pipe cleaners
- Battery (coin cell)
- Tape
- Rubber band
- Decorations (beads, shapes, googly eyes)
- Clothespin
- Popsicle sticks

Plan

PREPARING THE LED

1. Find Anode(+)
   & Cathode(-)
2. Gently bend the long leg outward
3. Keep the legs clean





Plan

PREPARING THE PIPE CLEANERS

1. Remove fuzz from the ends
2. Twist metal ends around LED legs
3. Make sure metal touches metal

Connecting Pipe Cleaners and Batteries

1. Take two pipe cleaners
2. Remove fuzz from each end
3. Make connection to diodes by twisting together

Plan

It’s time to design a light-up accessory for Brightwear Co.!

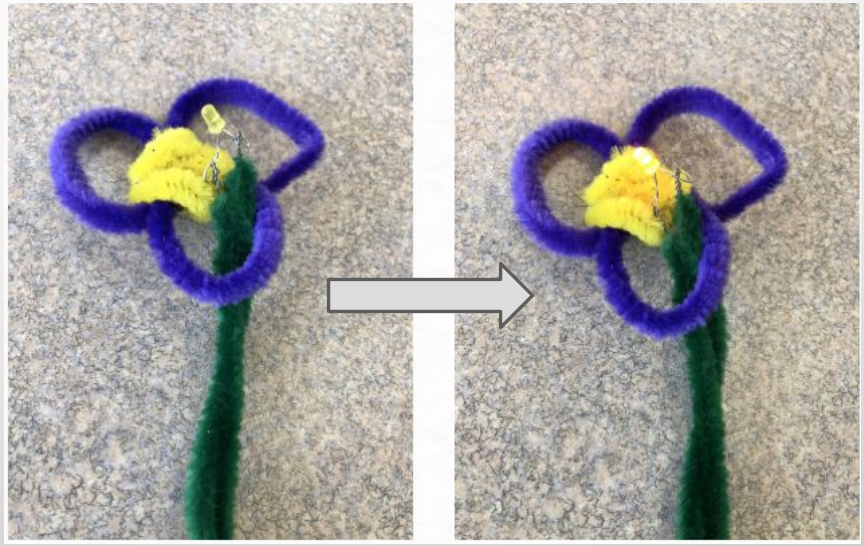
With your teammates, create plans for three different designs and sketch them. Make sure to label all materials you are planning to use.

DESIGN YOUR PROTOTYPE

Try

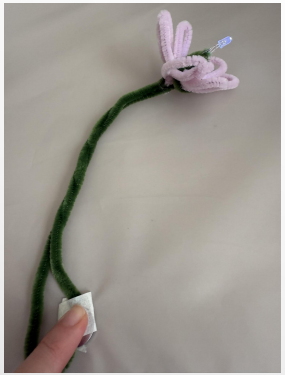
Test

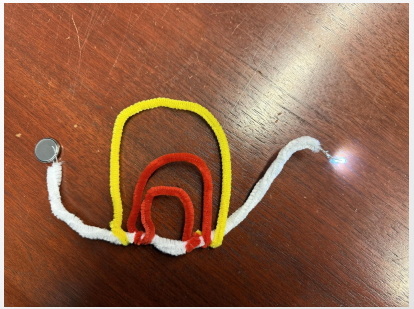
- If the bulb lights up, that means your design is successful!
- Is it fun to wear?
- Does it help keep people safe in the dark?

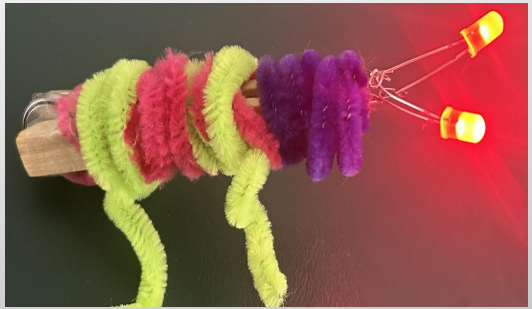


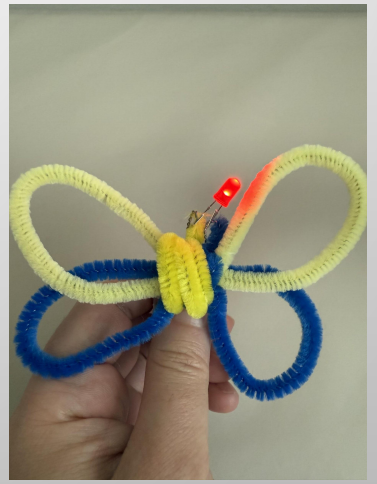
Decide

DESIGN YOUR PROTOTYPE





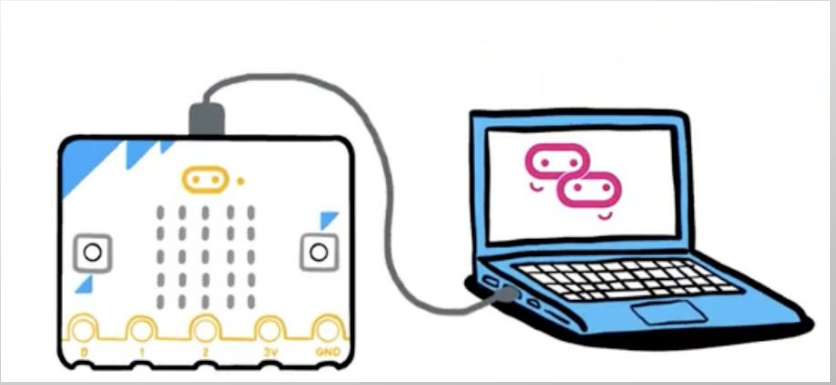




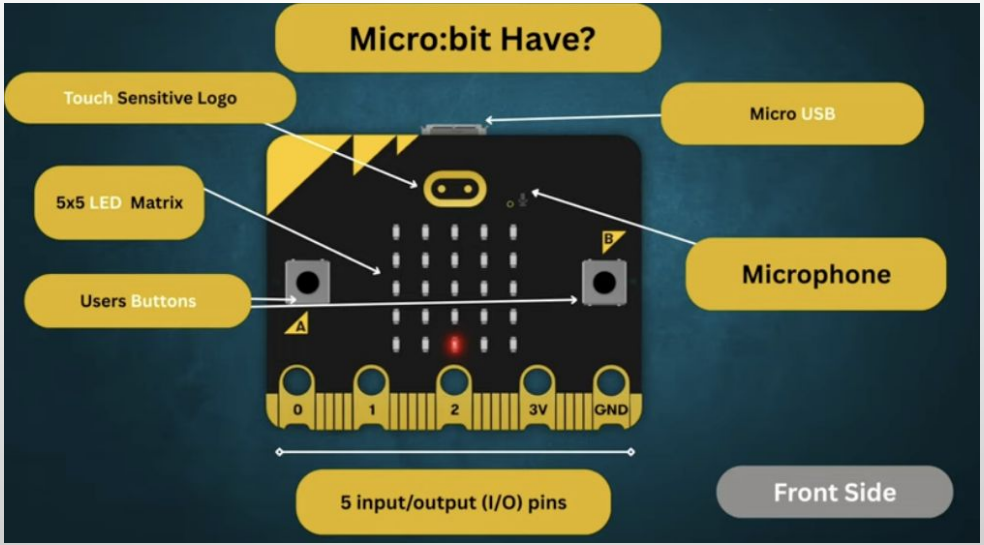

THE MICRO:BIT
CHALLENGE GAMES

WHAT IS A MICRO:BIT?

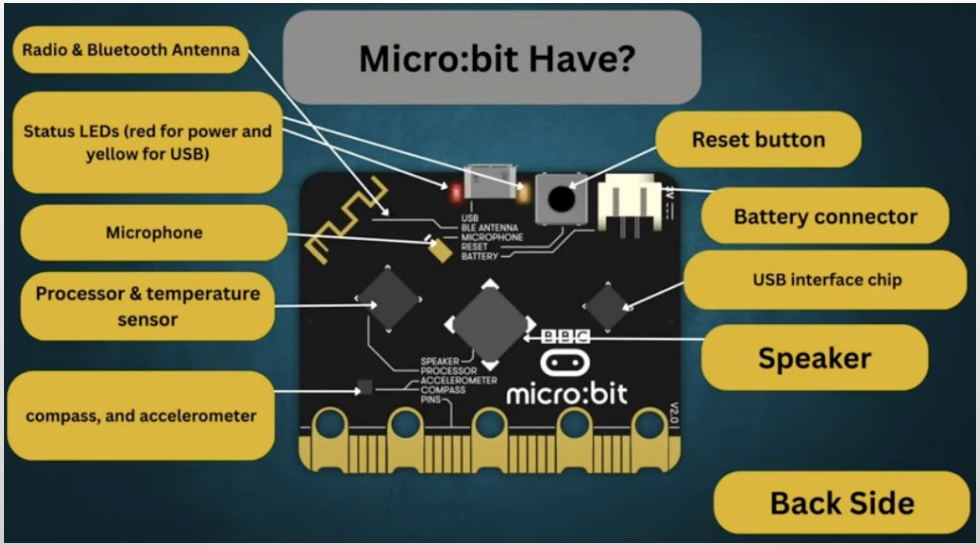
- A small computer
- You write instruction in code, and it does what you tell it to do
- It has an LED display output
- https://mbit.io/lessons-microbit-video



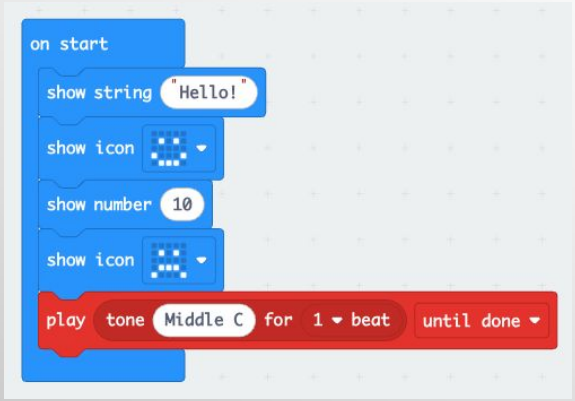
FRONT SIDE

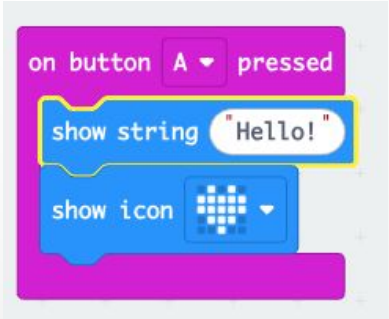

Micro:bit Have?
Touch Sensitive Logo
Micro USB
5x5 LED Matrix
Microphone
Users Buttons
A
B
0
1
2
3V
GND
5 input/output (I/O) pins
Front Side

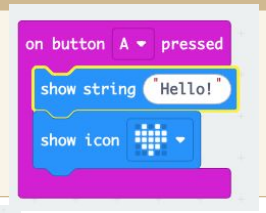
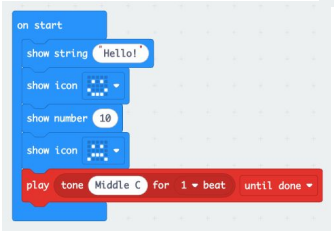
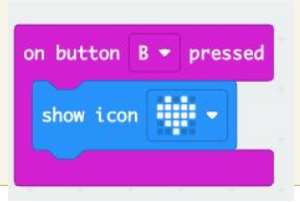
BACK SIDE


Micro:bit Have?
Radio & Bluetooth Antenna
Status LEDs (red for power and yellow for USB)
Microphone
Processor & temperature sensor
compass, and accelerometer
Reset button
Battery connector
USB interface chip
Speaker
Back Side
USB
BLE ANTENNA
MICROPHONE
RESET
BATTERY
SPEAKER
PROCESSOR
ACCELEROMETER
COMPASS
PINS
micro:bit
V2.0

OFFLINE CODING

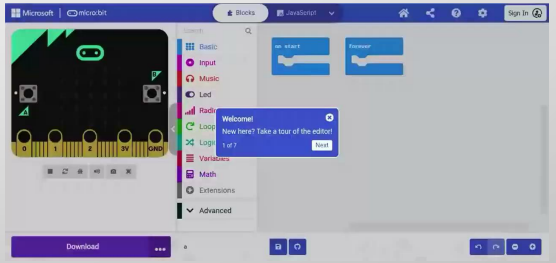




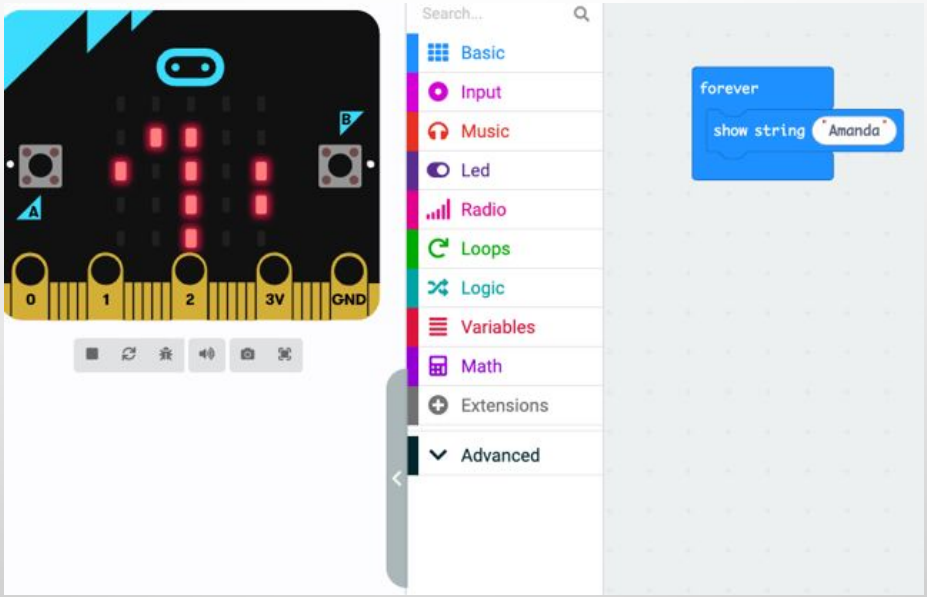
Code	→	Scenario
		The MicroBit will display "hello" and a heart when Button A is pressed.
		The MicroBit will display "hello", smiley face, number 10, frown face, and then play a short beat.
		The MicroBit will display a heart when Button B is pressed.
		When the MicroBit is shaken, it will generate a random number between 0 and 6.
		The MicroBit will display Amanda and then a heart (forever).

MAKE CODE Instructions

1. Go to makecode.microbit.org
2. No need to sign in, just click “New Project”
3. Give your project a name (something cool) and click Create
4. You are now on the code editor
5. Complete the “tour of the editor”

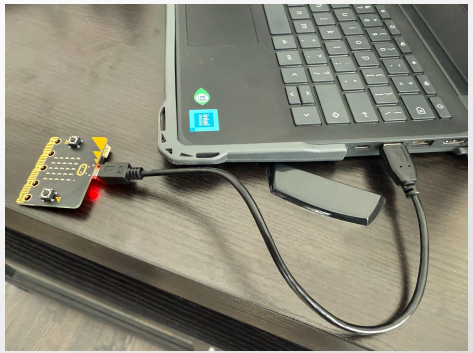


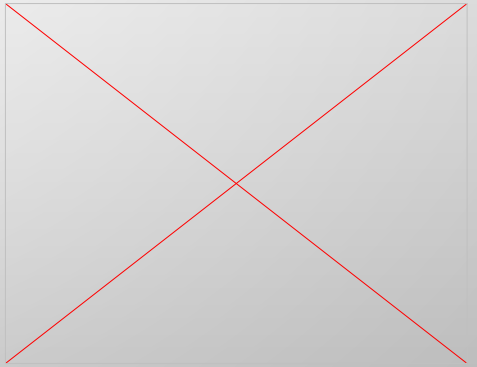
LET’S MAKE A NAME BADGE - Together



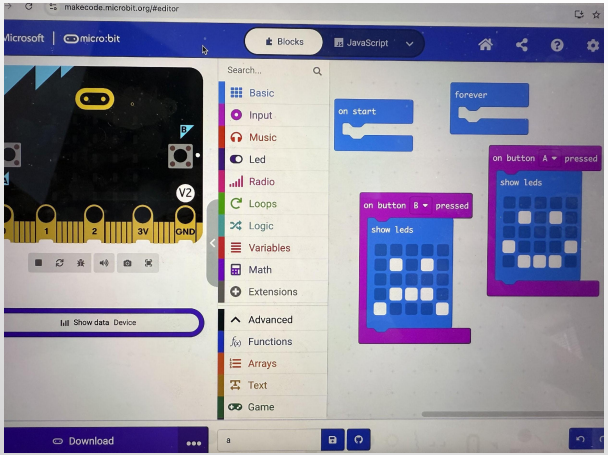
MAKE CODE Instructions

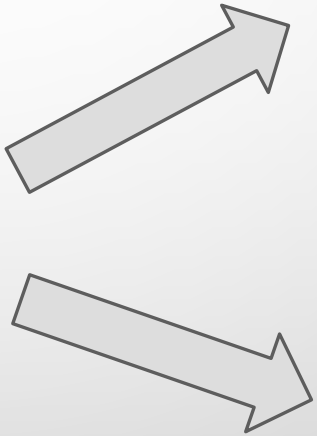
1. Connect one end of the cable to your Micro:Bit and the other end into your computer (don’t worry about the battery pack)
2. Follow the order of the steps shown in the video.
3. After you finished your coding ideas, click the download button on the bottom left corner of the screen.

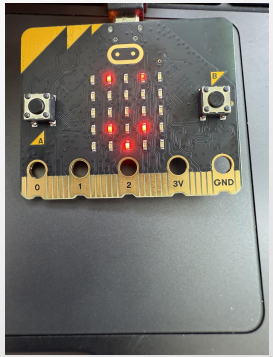


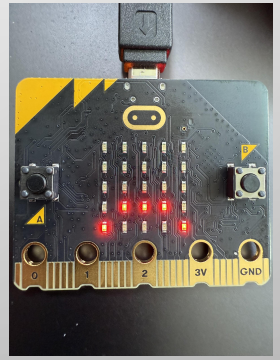


The Micro:Bit displays your code!

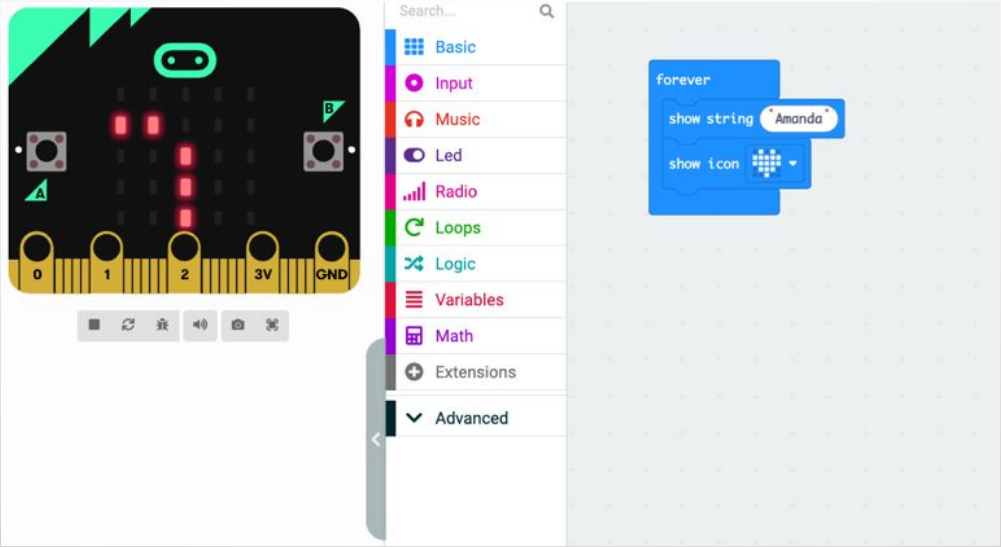






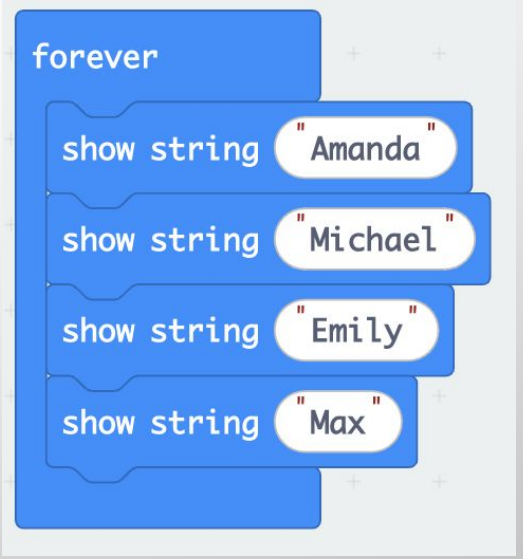


LET’S MAKE A NAME BADGE WITH AN ICON - Together

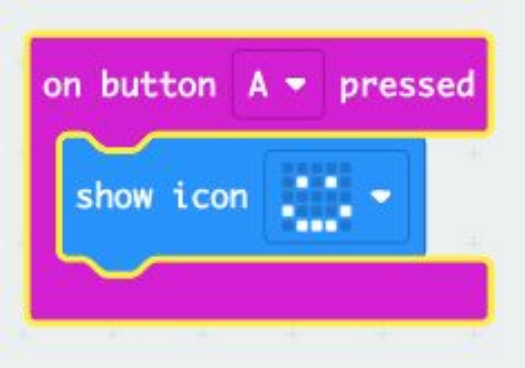


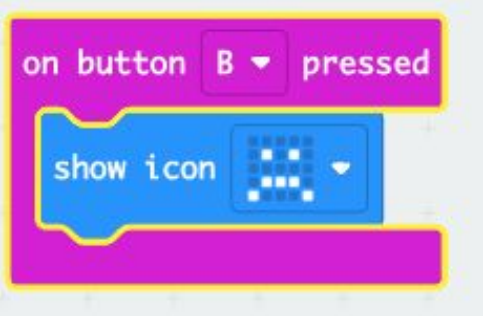
LET'S MAKE A NAME BADGE WITH ALL TEAM MEMBERS' NAMES!

1. The first team member drags the "show string" block into the loop and enters their name
2. The second team member copies this block and then replaces the text with their name
3. Continue until all team members' names are shown on the name badge

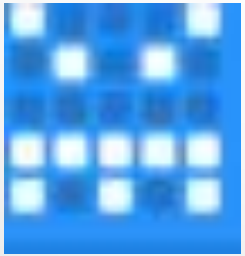


LET’S CODE OUR FEELINGS - Together





CODE IT TO SHOW HOW YOU FEEL NOW!



This is the correct answer!

Dear Contestant,

Welcome to Mr. Beast's Micro:Bit Challenge Games! This is only the first stage of the challenge, but you must complete the following 4 tasks in order to advance to the next stage of the competition. In addition, your school might even be featured on the channel!

- First, you must program the micro:bit to play a musical note for 1 beat when Button A is pressed.
- Next, you must modify your program to display any type of icon (you can create your own!) when Button B is pressed.
- Now, you must program your micro:bit to display a random number between 1 and 10 when the micro:bit is shaken.

Once you complete all of the tasks, please give your teacher your completed Mr. Beast Challenge Sheet.

Best of luck,

Mr. Beast

Code You Wrote	Output of the Code
Challenge 1: Play a musical note when Button A is pressed? *Code you wrote*	**Output of the code:**
Challenge 2: Display an icon when Button B is pressed *Code for music:*	**Output of the code:**
Challenge 3: Display a random number (1-10) when shaken? *Code for interaction:*	**Output of the code:**

Dear Contestants,

Congratulations on advancing to the second round of Mr. Beast's CodeBeast Ultimate MicroBit Challenge Games! In this second and final stage of the challenge, you must create an animation on the LED screen of your MicroBit. The character for the animation can be an icon (heart, arrow, etc.), an animal (duck, cat, etc.), or other character that you come up with. Because it is an animation, the character must move. Bonus points will be added for including sound, interaction (for example, the character says "Hello" when Button A is pressed), and/or a special creative feature that you include.

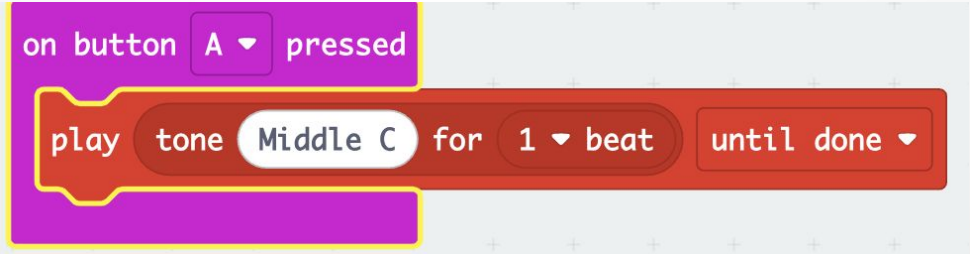
Once you complete this task, please show your MicroBit and completed Challege Sheet to your teacher.

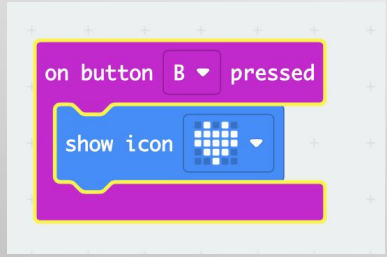
Best of luck,

Mr. Beast

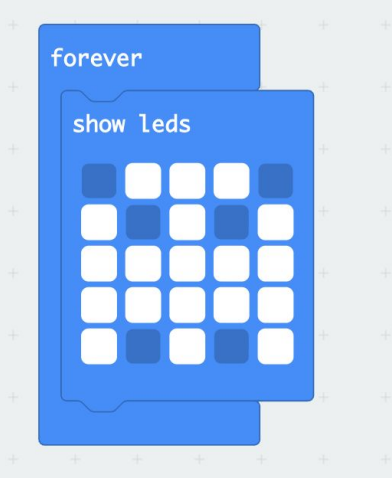
Code You Wrote	Output of the Code
What is your character? What does your character do for animation? *Code for character and animation:*	**Output of the code:**
Bonus: Does your animation include music? *Code for music:*	**Output of the code:**
Bonus: Is there interaction with your character? *Code for interaction:*	**Output of the code:**
Bonus: Does your character do anything else that is special? *Code that makes your character special:*	**Output of the code:**

CODES


on button A pressed
play tone Middle C for 1 beat until done


on button B pressed
show icon


on shake
show number pick random 0 to 10


forever
show leds

EXTRA CHALLENGE

If you were able to complete all 4 of challenges of the first stage, Mr. Beast has a harder task for you that builds on to the last challenge (random number generator). Your task now is to program the micro:bit so that if it is shaken and the button A is pressed (at the same time), then it should display a random number from 0 to 10 to the screen of the micro:bit. If this number is 7, the micro:bit should play the tone “Middle C,” if this number is 5, the micro:bit should play the tone “High B,” for any other number, the micro:bit should play the tone “Low C”

EXTRA CHALLENGE SOLUTION