EECS16A Imaging 1

TA, ASE, ASE, ASE

Please sit in front of a lab station with a partner! You need to use the towers!

IMPORTANT: ROOM CAPACITY

- We can’t have more than 49 people in this room
- If lab is full, we will first kick out **all** waitlisted folks
- If you **lie** about being enrolled in this section, you will be **REMOVED** from the course
  - Please be ready to show either CalCentral enrollment or an email confirming a switch.

Semester Outline

Imaging Module

Touchscreen Module

Locationing Module

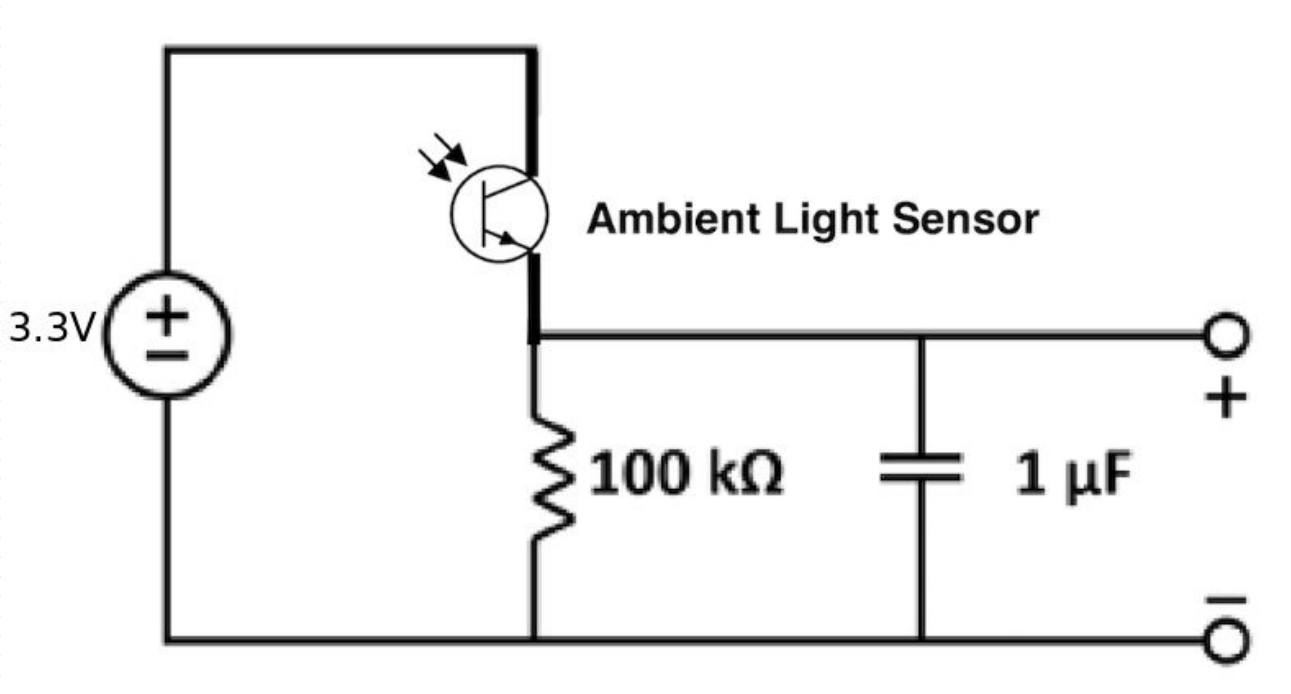
Why Imaging?

- Use linear algebra techniques to capture real world images with limited sensors
- Today:
  - Finding a link between physical quantities and voltage
  - If you can digitize it, you can do anything (IOT devices, internet, code, processing)

Today's Lab: Imaging Part 1

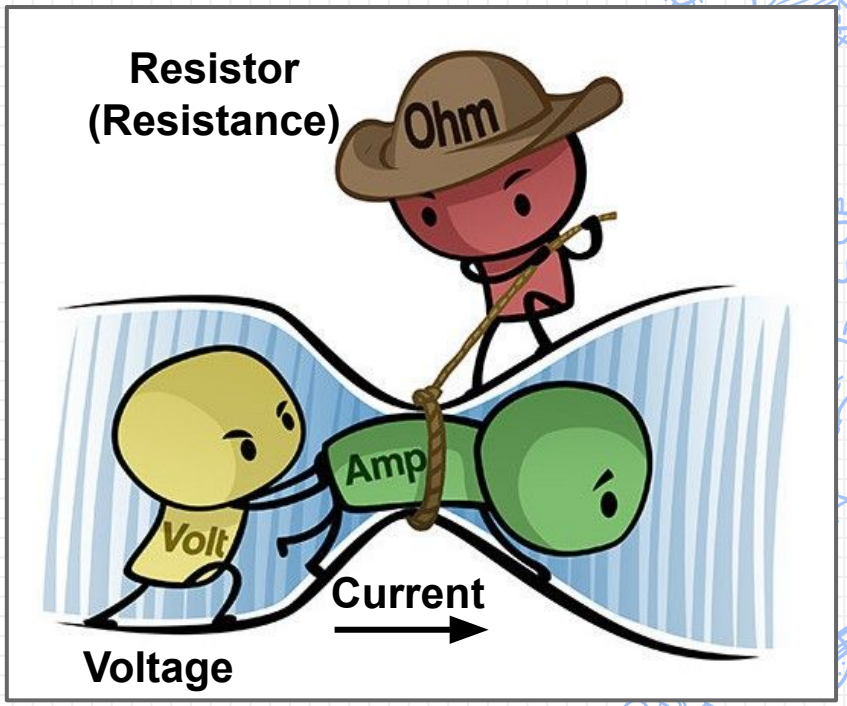
- Learn to use PSU and Oscilloscope
- Distribute materials (TI MSP430F5529 + lab kit)
  - More on this later
- Circuits + Breadboarding 101
- Build circuit that reacts to light intensity
  - Use Oscilloscope and Launchpad to see how the circuit behaves
- Graded checkoff starts today!

Our circuit



A Little Physics: Voltage, Current, and Resistors

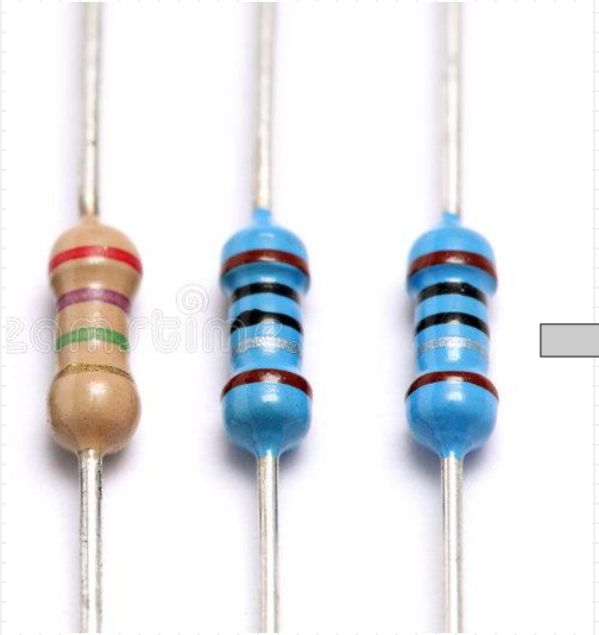
- **Voltage [Volts]** - pushes charge through circuit
- **Current [Amps]** - flow of charge through circuit
  - 1 Amp = 1 charge per second
- **Resistor [Ohms]** - circuit component that resists the flow of charge through circuit

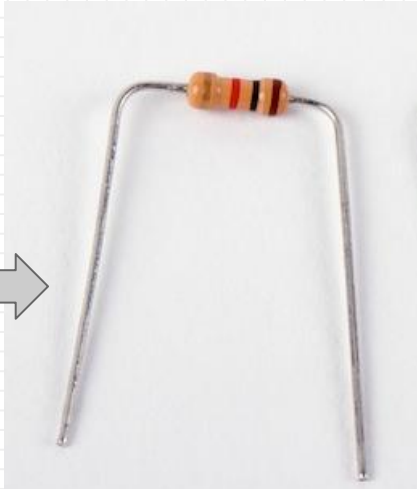


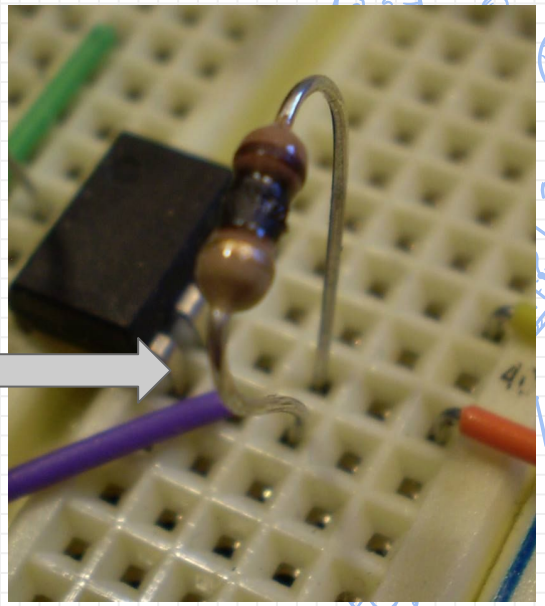
Simple Circuit: The Tools™

- Components
  - Resistors
  - Capacitors
  - Voltage Source
- Wires / Jumpers [male-to-male vs male-to-female]

What’s in your circuit? : Resistors

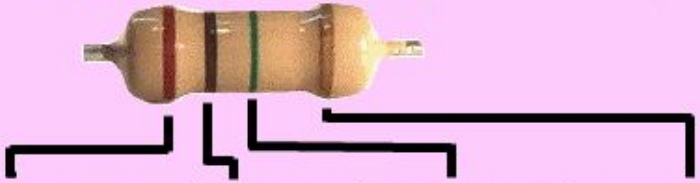






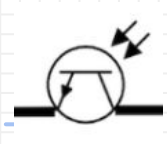
What’s on your circuit? : Resistors

4 Band Resistor Color Coding



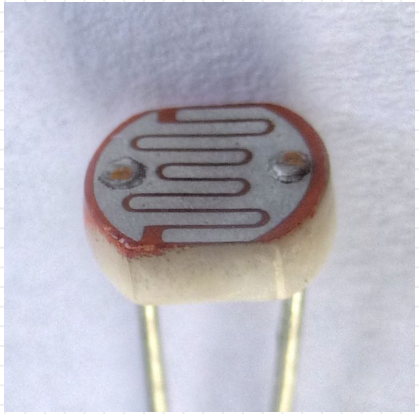
COLOR	1ST BAND	2ND BAND	MULTIPLIER	TOLERANCE
BLACK	0	0	x1Ω	
BROWN	1	1	x10Ω	±1%
RED	2	2	x100Ω	±2%
ORANGE	3	3	x1000Ω	
YELLOW	4	4	x10000Ω	
GREEN	5	5	x100000Ω	±0.5%
BLUE	6	6	x1000000Ω	±0.25
VIOLET	7	7	x10000000Ω	±0.10
GREY	8	8		±0.05
WHITE	9	9		
GOLD			0.1	±5%
SILVER			0.01	±10%

Ambient Light Sensor

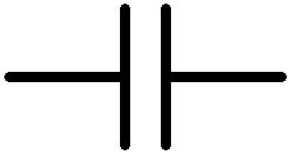


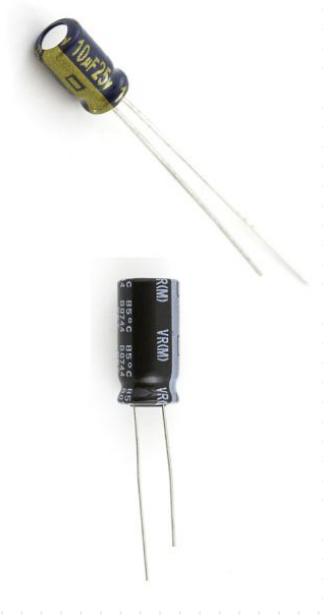
It’s a type of resistor whose value can change depending how much light there is around it!

Direction matters!



Equipment for Today: Capacitors



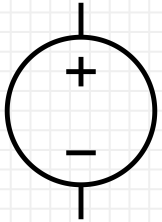


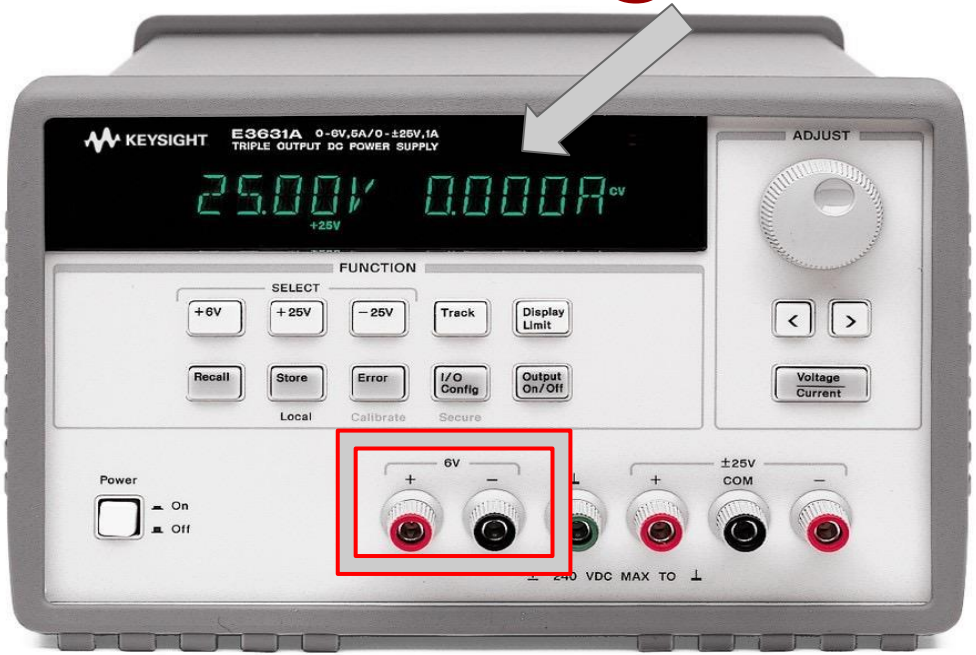
They store your charge!
Called capacitors because they have a set capacity (in Farads)

Equipment for Today: Wires/Jumpers

Equipment for Today: Voltage Source

IMPORTANT: Always keep current limited @ 0.1 A limit





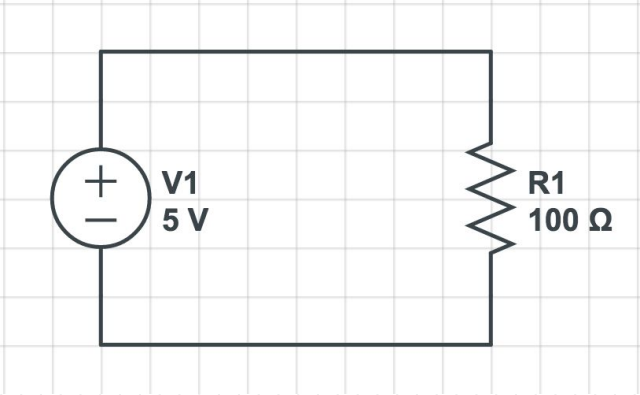
PSU cables are hanging on back wall

Simple Circuit: The Theory

- Components
- Nodes
  - Point in circuit where circuit elements meet
  - Wire between components are considered part of one node
- We know you don’t know much about circuits yet; we’ve given you very detailed instructions on how to build the circuit in the lab

Simple Circuit: The Theory™

- Components (Resistors, LEDs, Capacitors)
- Nodes
  - Point in circuit where circuit elements meet
  - Wire between components are considered part of one node



What components?

How many nodes?

Where are these nodes?

Simple Circuit: The Theory™

- Components (Resistors, LEDs, Capacitors)
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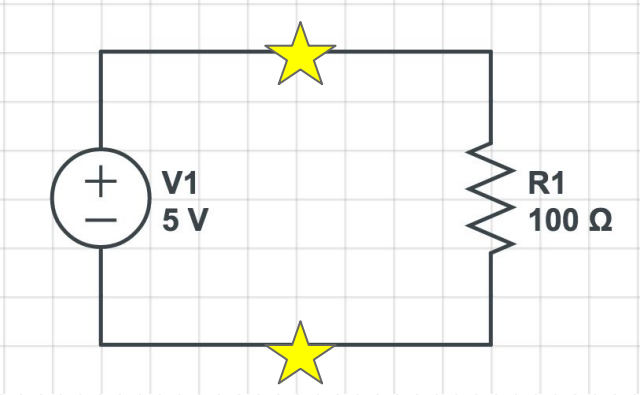

What components?

Voltage source, resistor

How many nodes? **2**

Where are these nodes?

Simple Circuit: The Theory™

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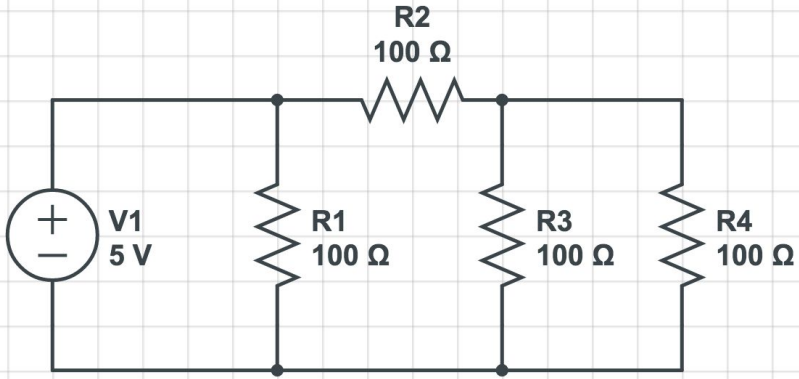


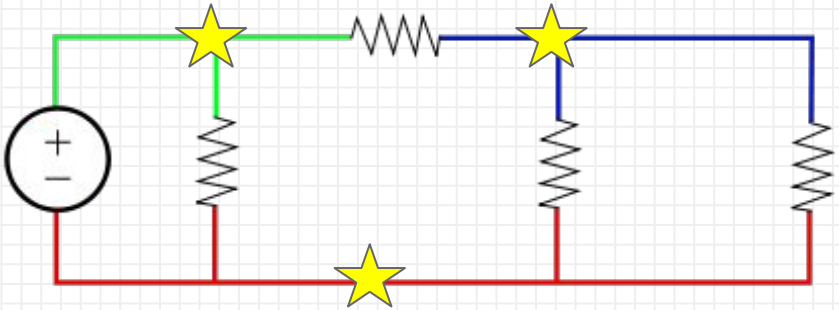
What components?

How many nodes?

Where are these nodes?

Simple Circuit: The Theory™

- Components (Resistors, LEDs, Capacitors)
- Nodes
  - Point in circuit where circuit elements meet
  - Wire between components are considered part of one node

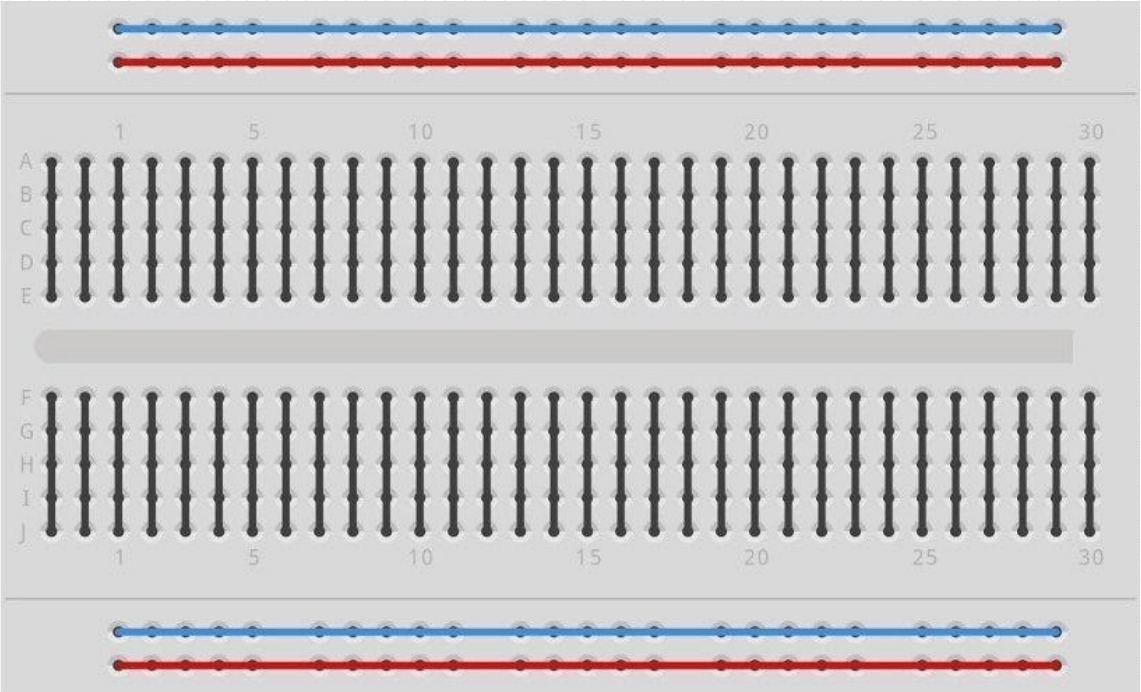


What components? **Same**

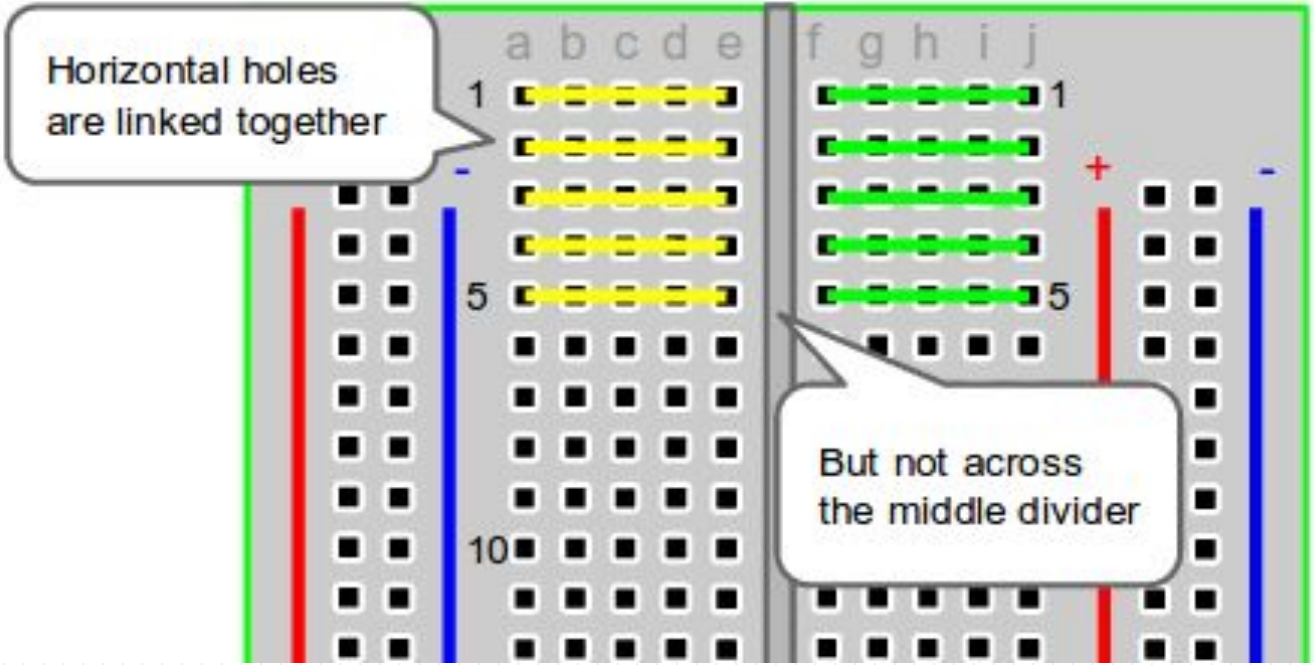
How many nodes? **3**

Where are these nodes?

Breadboard

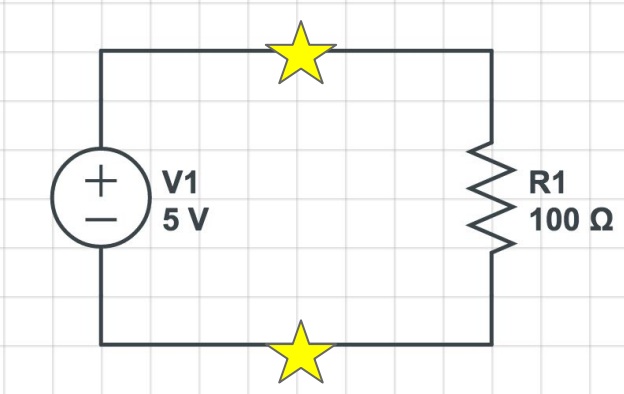


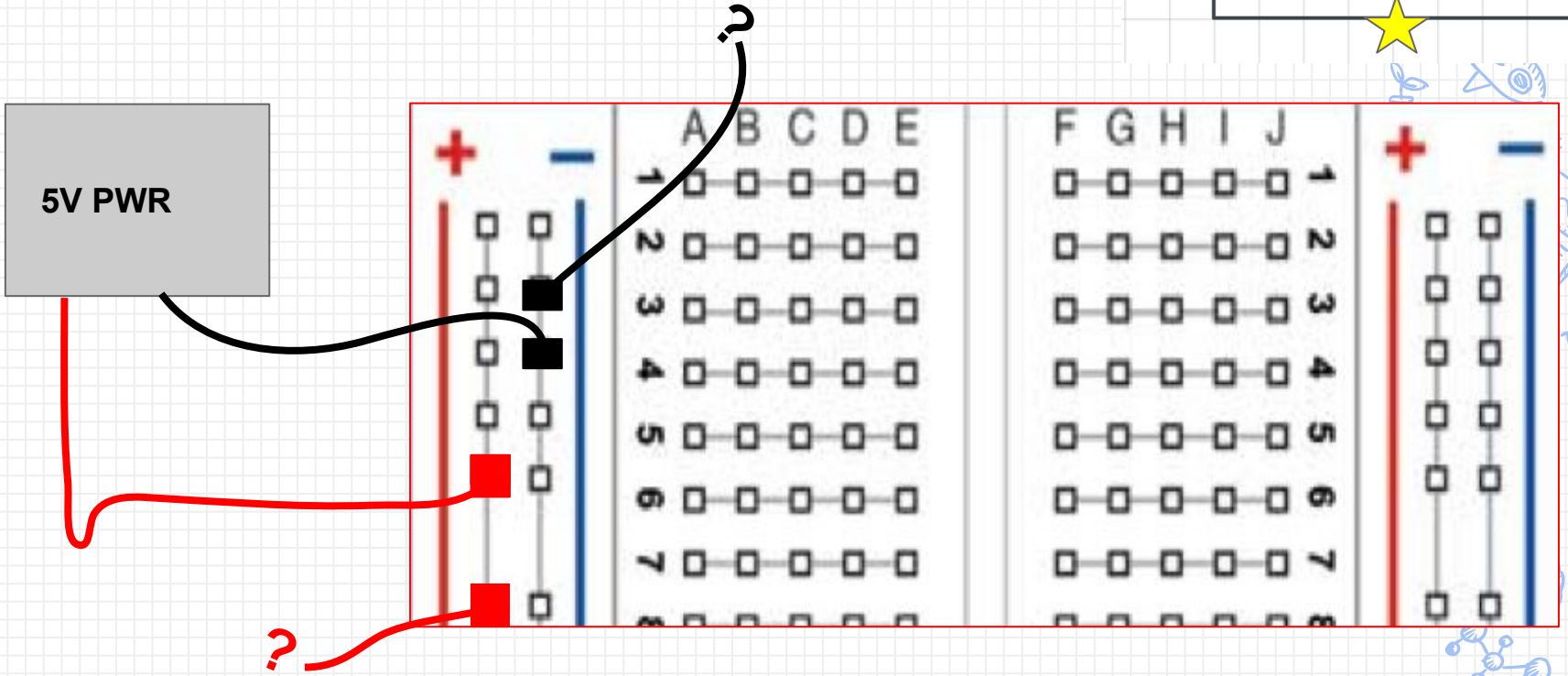
Breadboard


Horizontal holes are linked together
a b c d e
f g h i j
1
5
10
1
5
-
+
-
But not across the middle divider

Breadboard Do’s and Don’t’s

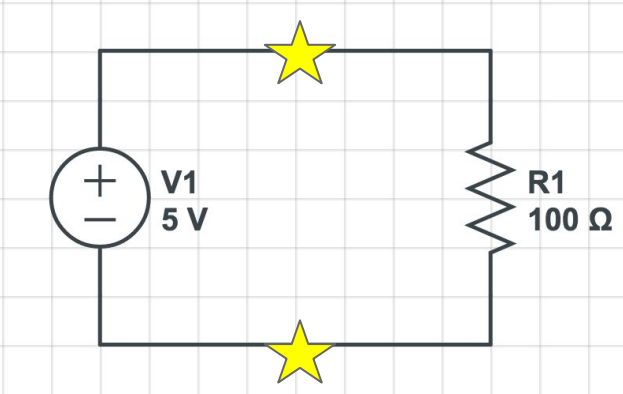
How do we make this circuit? →

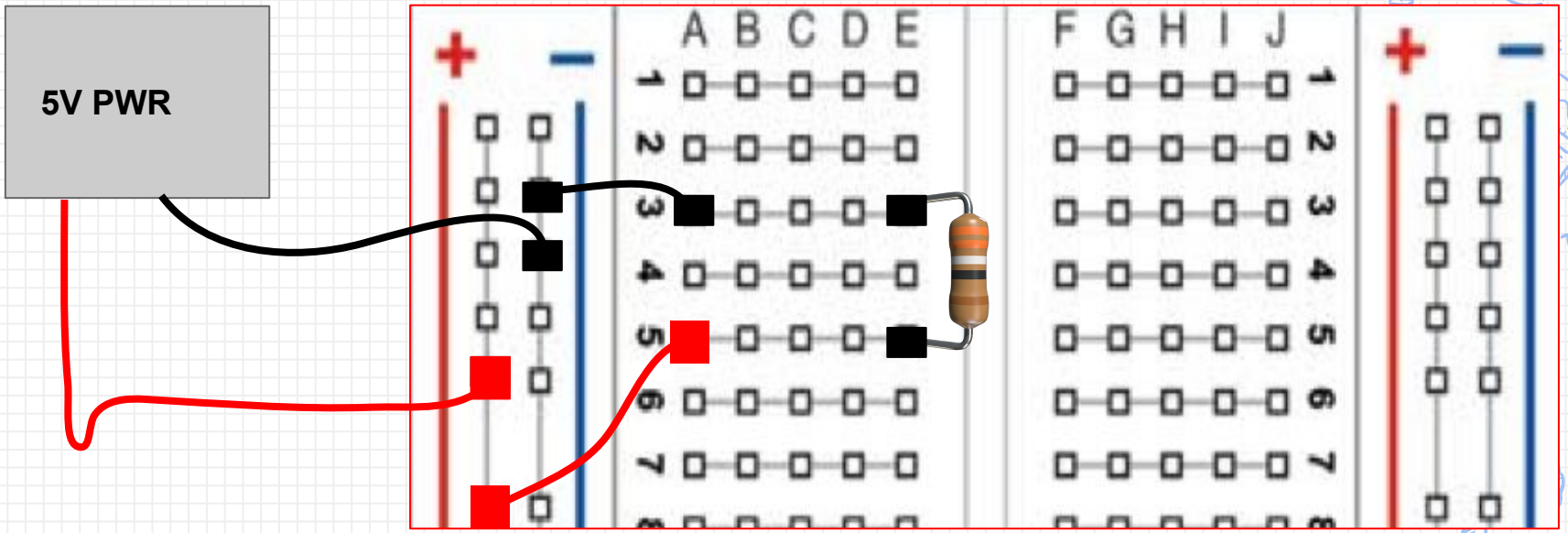




Breadboard Do’s and Don’t’s

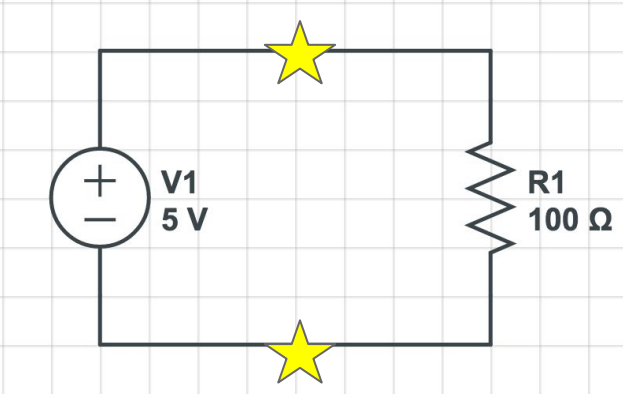
✓ **Do** plug component’s ends into two different rows - separate nodes

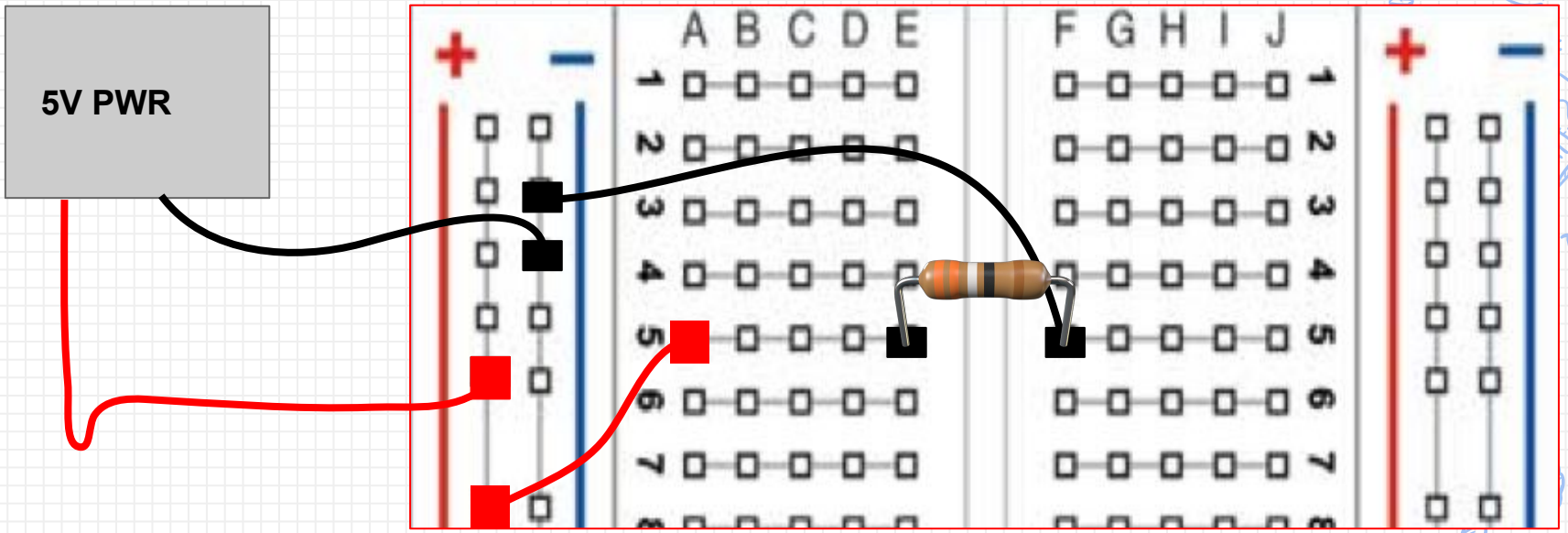




Breadboard Do’s and Don’t’s

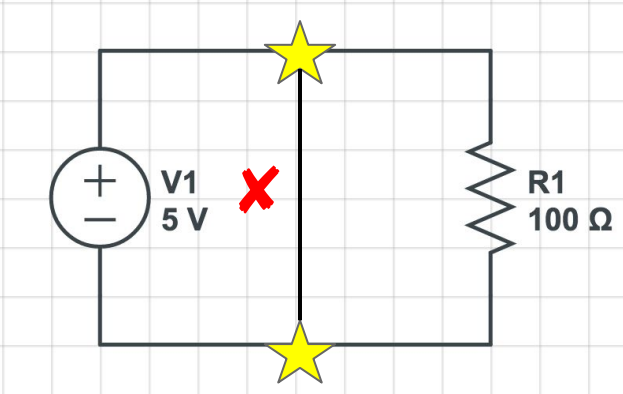
✓ **Do** plug components across the gap in your breadboard - A-E and F-J are separate

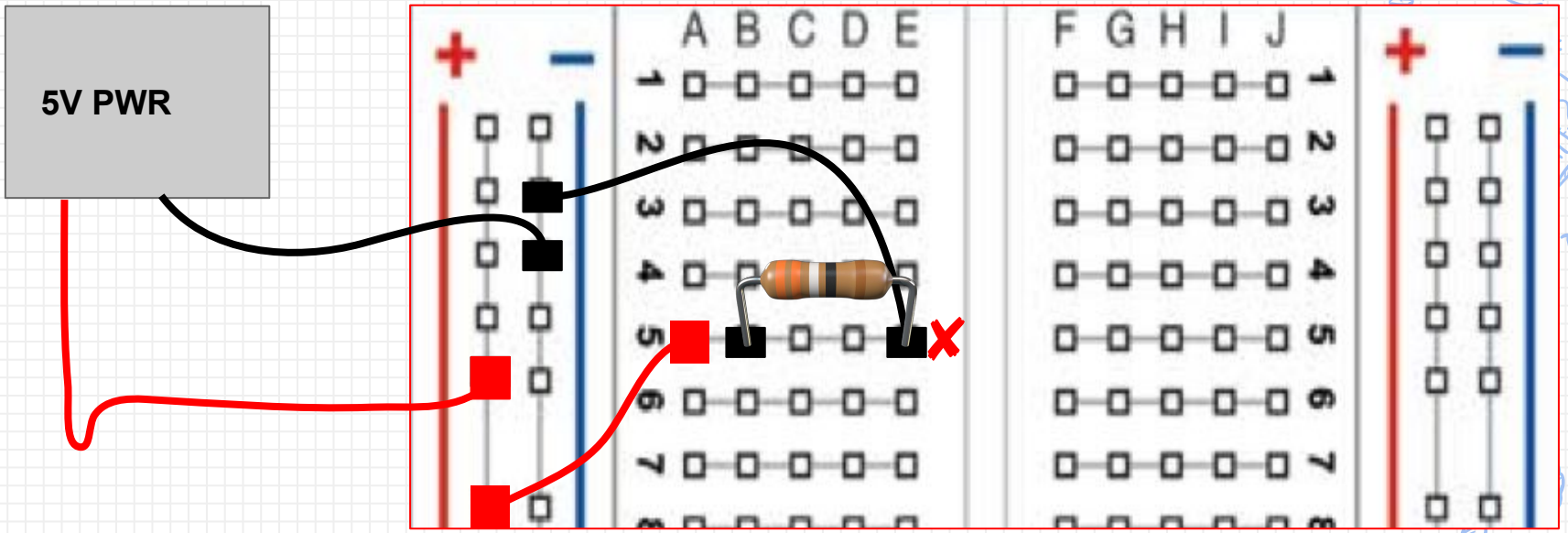




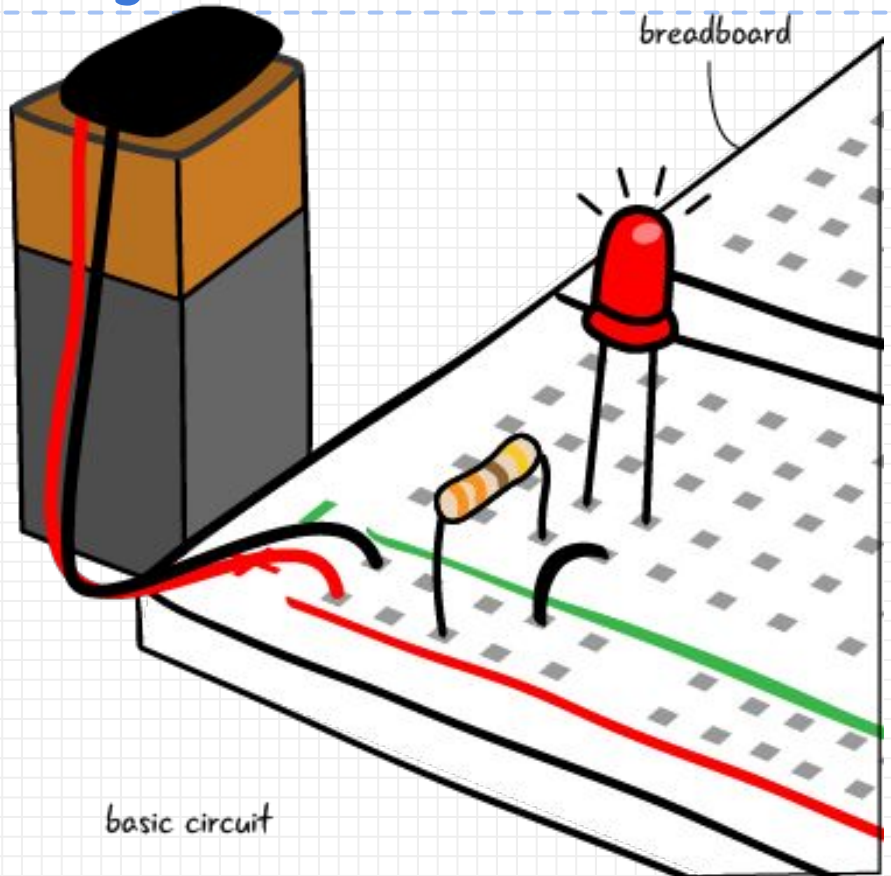
Breadboard Do’s and Don’t’s

✘ **Do not** plug both ends of component into the same row! This creates a short

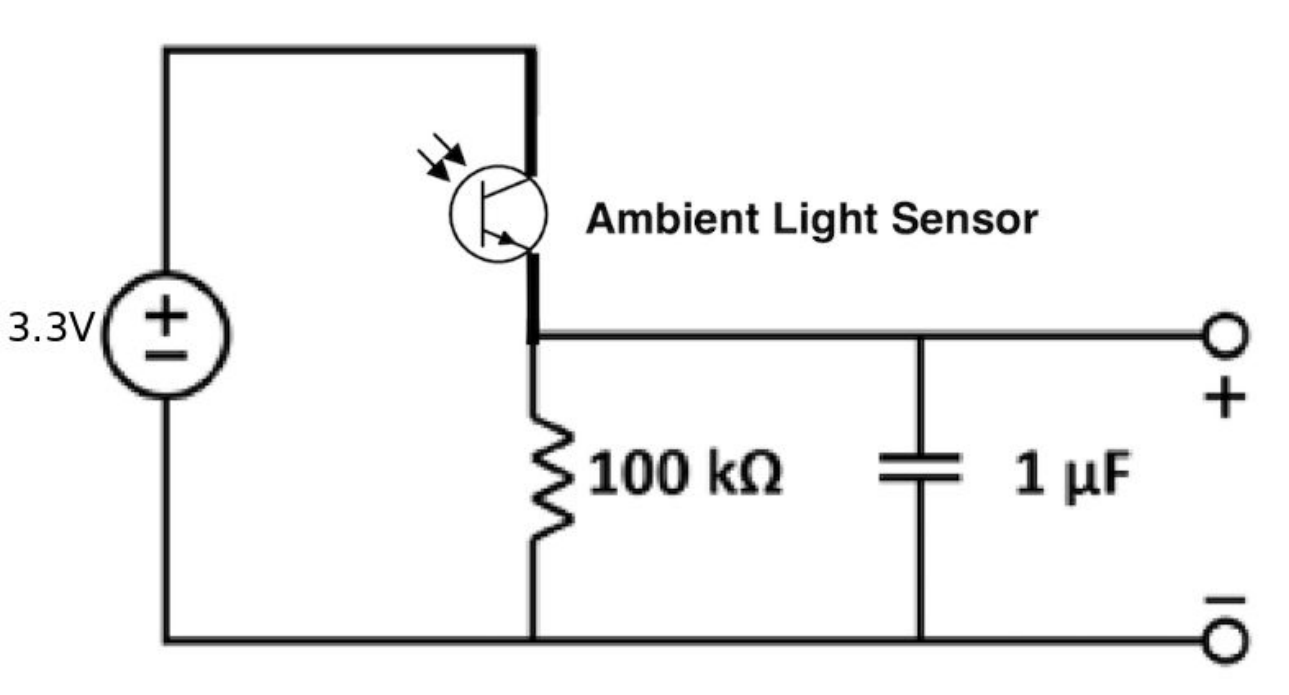




Breadboarding Color Convention



Light-detecting Circuit

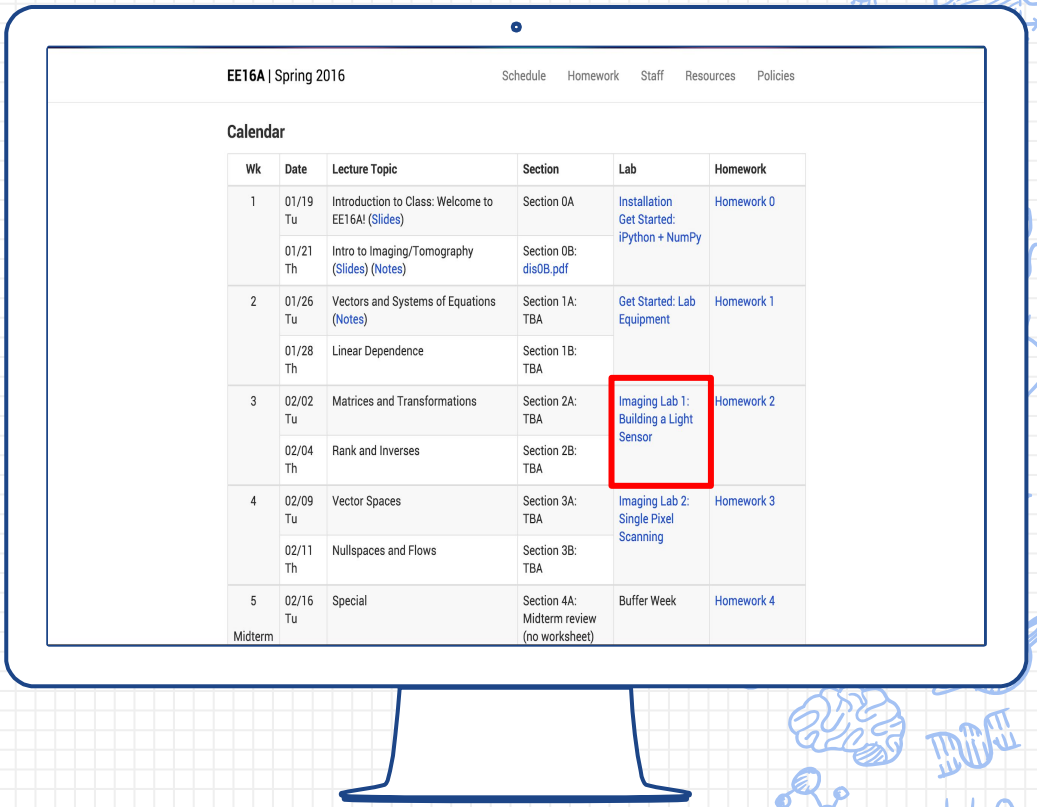


How to get your lab kit (1 per student)

- After finishing ~20% of the lab you will reach the end of the “Obtaining a Lab Kit” section
- Call over a lab staff member and: (also described in lab notebook)
  - Show answers to PSU, Oscilloscope, and lab kit questions
  - Demonstrate how to use the equipment
  - Be able to name components in the lab kit
- Everything in kit (bag+Launchpad) is yours to keep but EACH STUDENT HAS TO BRING THEM BACK TO EVERY LAB

How to start

- Please use the station desktops for this lab
- If you need an instructional account, let us know
- Work in pairs
- This week's lab is listed as **"Imaging Lab 1"**
- **Make sure website says Spring 2020**



EE16A | Spring 2016

Schedule Homework Staff Resources Policies

Calendar

Wk	Date	Lecture Topic	Section	Lab	Homework
1	01/19 Tu	Introduction to Class: Welcome to EE16A! (Slides)	Section 0A	Installation Get Started: iPython + NumPy	Homework 0
	01/21 Th	Intro to Imaging/Tomography (Slides) (Notes)	Section 0B: dis0B.pdf		
2	01/26 Tu	Vectors and Systems of Equations (Notes)	Section 1A: TBA	Get Started: Lab Equipment	Homework 1
	01/28 Th	Linear Dependence	Section 1B: TBA		
3	02/02 Tu	Matrices and Transformations	Section 2A: TBA	Imaging Lab 1: Building a Light Sensor	Homework 2
	02/04 Th	Rank and Inverses	Section 2B: TBA		
4	02/09 Tu	Vector Spaces	Section 3A: TBA	Imaging Lab 2: Single Pixel Scanning	Homework 3
	02/11 Th	Nullspaces and Flows	Section 3B: TBA		
5 Midterm	02/16 Tu	Special	Section 4A: Midterm review (no worksheet)	Buffer Week	Homework 4

FAQ

✘ BEFORE LEAVING, PLEASE RETURN THE WIRES, POWER OFF YOUR MACHINES, AND SIGN OUT OF THE COMPUTERS

- **EXTRACT (unzip) the downloaded file before doing anything - ask us if you have questions**
- **SHIFT+RIGHT CLICK** on a folder window to open in **CMD**
  - Select ‘open powershell window here’
  - **‘ipython notebook**’ to open notebook inside prompt
  - Let us know **IMMEDIATELY** if you’re having trouble with this
- Keep output of the voltage source **off** while you are building things
- Probes are in the back
- **Make sure you are using the right resistor (Brown Black Gold) - get at TA desk**
- **Make sure your ambient light sensor is in the right direction**
- **DO NOT PIP INSTALL ANYTHING, keep the install as is**
- Complete the lab in **PAIRS**, do ONE setup per group
- Make sure current limit of power supply is set to 0.1A
- DON’T LEAVE/CLEAN UP WITHOUT BEING CHECKED OFF FIRST