



# ARDUINO STUDENT KIT



# A PROGRAMMING AND ELECTRONICS KIT DESIGNED FOR REMOTE LEARNING, INCLUDING STEP-BY-STEP LESSONS AND COMPLETE GUIDANCE

LEARN THE BASICS OF PROGRAMMING, CODING, AND ELECTRONICS,  
INCLUDING CURRENT, VOLTAGE AND DIGITAL LOGIC. NO PRIOR KNOWLEDGE  
OR EXPERIENCE IS REQUIRED!

## WHAT IS THE ARDUINO STUDENT KIT?

- Affordable and inspired by the original Arduino Starter Kit, the **Arduino Student Kit** provides step-by-step-lessons with information and learning material, such as detailed teacher guidance, vocabulary, exercises, extra optional activities, concepts, history, and interesting facts, for a complete and in-depth class experience for middle school students aged 11 +.
- You'll get all the hardware and software you need for one person, making it ideal to use for **remote teaching, homeschooling, and self-learning.**
- Educators can teach their class remotely using the kits, and parents can use the kit as a homeschool tool for their child to learn at their own pace.



# BENEFITS OF THE ARDUINO STUDENT KIT

- Affordable
- Quick and easy to get started with step-by-step lessons
- No experience required for educators, parents or children
- Lessons are fun and engaging with real-world topics
- Use the kit at home just like students would be using in class
- Go to at the speed of individual ability
- Improve problem-solving and critical thinking skills



# CURRICULUM ALIGNMENT

This Student Kit follows the US Common Standards Concepts and focuses on core concepts of coding and electronics.

## KEY LEARNING VALUES

- Learn electronics step-by-step, with no prior coding or electronics experience required
- Learn about current, voltage, digital logic, and programming



- Suitable for ages 11- 14
- Individual use
- 9 lessons and 2 open-ended projects
- Available in English and Spanish. Italian and German coming soon! (2020)





The Arduino Student Kit includes:

1 Arduino Uno rev 3, 1 USB cable, 1 Breadboard 400 points, 1 multimeter, 1 Solid core jumper wire, 1 Easy-to-assemble plastic base, 1 9v battery snap, 1 Stranded jumper wire (black), 1 Stranded jumper wires (red), 1 Phototransistor, 2 Potentiometers 10k Ohms, 2 Knob potentiometers, 5 Pushbuttons, 1 Temperature sensor [TMP36], 5 LEDs (red), 5 LEDs (green), 5 LEDs (yellow), 5 LEDs (blue), 1 Piezo capsule [PKM17EPP-4001-B0], 2 Capacitors 100uF, 5 Resistors 220 Ohms, 5 Resistors 560 Ohms, 1 Resistors 10k Ohms, 1 Resistors 10k Ohms, 2 Resistors 4.7 KOhms, 1 Battery 9V, 1 Female-male Jumper wires (red), 1 Female-male Jumper Wires (black), 1 small servo motor , 3 nuts and bolts.

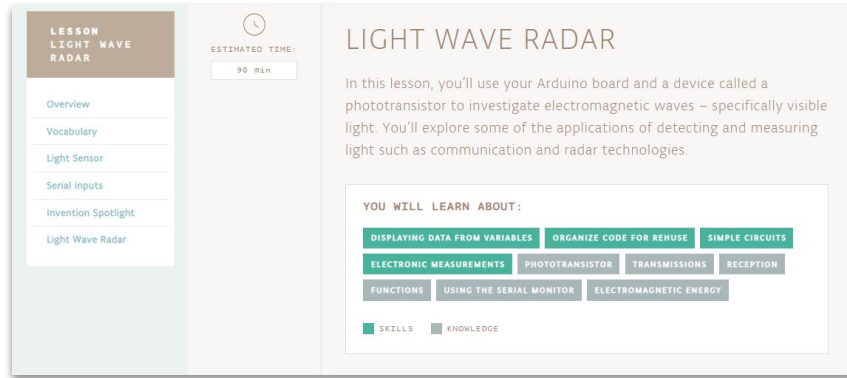
- 1 Arduino Uno Rev 3 board
- A collection of sensors and actuators
- Access to an online platform with content and extra resources for extended and in-depth learning
- Specific online content for educators, with guidance

# CONTENT

- **Online content for 9 lessons and 2 open-ended group projects** for middle school students (11+).
- **Optional and useful extra content** for both educators and students , such as resources for extended learning, teacher notes for educators, and further notes for students.
- Each lesson builds off the next and provides the **opportunity to apply skills and concepts** that were covered in previous lessons.
- Each lesson is designed to be completed **individually, working with one Arduino Student Kit and one computer.**
- The online course comes with **a logbook in a PDF format** that students complete as they work through the lessons.







**LESSON**  
**LIGHT WAVE**  
**RADAR**

ESTIMATED TIME:  
90 min

## LIGHT WAVE RADAR

In this lesson, you'll use your Arduino board and a device called a phototransistor to investigate electromagnetic waves – specifically visible light. You'll explore some of the applications of detecting and measuring light such as communication and radar technologies.

YOU WILL LEARN ABOUT:

DISPLAYING DATA FROM VARIABLES	ORGANIZE CODE FOR REUSE	SIMPLE CIRCUITS
ELECTRONIC MEASUREMENTS	PHOTOTRANSISTOR	TRANSMISSIONS
RECEPTION	FUNCTIONS	USING THE SERIAL MONITOR
ELECTROMAGNETIC ENERGY		

■ SKILLS ■ KNOWLEDGE



## LIGHT WAVE RADAR

ESTIMATED TIME:  
90 min

## EXPLAINING THE LESSONS

Each lesson should last around **90 minutes**. The lessons are planned with the possibility of being divided in two ways:

- Covering the basics of electronics takes approximately **17 hours**
- Extra resources are provided within each lesson to provide extension possibilities. **These resources bring the total lesson time to 25 hours**



# EXPLAINING THE LESSONS

- The start of each lesson includes an overview, estimated completion times, and learning objectives.
- Throughout each lesson the teachers can use the helpful **teacher notes for lessons to go more smoothly**. The teacher notes are recommendations and extra information for teaching and learning guidance.
- Another learning tool inside the lessons is the **further notes for students**, including extended information for better understanding.

The screenshot shows a lesson interface for 'LESSON ELECTRICITY BASICS'. On the left is a sidebar with a menu containing 'Overview', 'Vocabulary', 'Invention Spotlight', 'Electricity and Circuits', and 'Measuring Electricity'. The main content area features a horizontal bar with material categories: COPPER, ALUMINIUM, GRAPHITE, WATER, GLASS, RUBBER, and AIR. Below this, a 'Note' explains the historical unit 'mho' for conductance. A 'FURTHER NOTES' section discusses the difficulty of understanding current, voltage, and resistance, using a water pipe analogy. At the bottom, a 'TEACHER NOTES' box states that it is the teacher's decision whether to use the water analogy.

**LESSON ELECTRICITY BASICS**

Overview  
Vocabulary  
Invention Spotlight  
Electricity and Circuits  
Measuring Electricity

COPPER ALUMINIUM GRAPHITE WATER GLASS RUBBER AIR

**Note:** In the past, the unit for measuring conductance was the mho – ohm spelled backward. The mho was an indication of the inverse relationship between conductance and resistance, measured in ohms.

**FURTHER NOTES**

Understanding the concepts of current, voltage, and resistance can be quite difficult. Sometimes people use the analogy of water in a pipe to explain these concepts. However, this analogy breaks down when talking about certain aspects of electricity such as alternating current, electric fields, and components like transistors. But the analogy might help to get a basic understanding of voltage, current, and resistance.

In this analogy, current is the amount of water flowing past a certain section of the pipe in a certain time frame. The more water, the more current. Voltage is like water pressure that pushes the water through the pipe. Usually, water is pushed through a pipe by pressure created by a pump or water tower. The stronger the pump or the higher the water tower, the more water pressure there is, causing the current to increase. Electrical resistance is like a valve in the pipe that reduces the flow of electricity. The more closed the valve is, the more resistance there is.

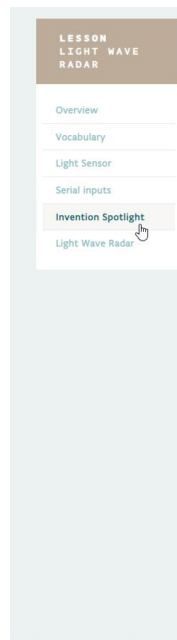
**TEACHER NOTES**

It is your decision whether to use the analogy of water to help explain these concepts or not.



# INVENTION SPOTLIGHT

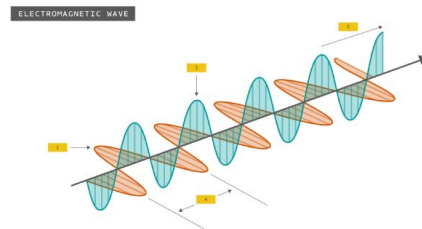
- The Arduino Student Kit takes students on a journey through past ideas, inventions, and innovations that have shaped our world.
- In the Invention Spotlight, students learn about different inventions and facts behind the topics and lessons, giving them a broader view and historical insight.



## INVENTION SPOTLIGHT

### Electromagnetic Energy

Thanks to Michael Faraday and other researchers, a new picture of the universe was coming into focus. Scientists had begun to suspect that the forces of electricity and magnetism (together called electromagnetic energy) traveled through space as invisible waves.



As a student, Heinrich Hertz became obsessed with creating an experiment to prove this. In 1887, he created an electrical transmitter and a receiver. The transmitter created an electrical spark that jumped between two live wires. In reaction, the receiver produced a spark of its own – even though it was several feet away!



## RESOURCES

- The resources are extra content which provide extended learning information for a more comprehensive experience. Resources aren't included in lesson time, but rather are optional extras, so it's up to students how they use this section. You'll find the resources on a content tab outside the lessons as well as in the "learn more about" button within the lessons themselves.

## VOCABULARY

- Every lesson comes with a vocabulary section including words that might be unfamiliar to students. There are numerous vocabulary activities a teacher can do with their students. These activities can be considered as in-class extension activities or as additional assignments for students to complete on their own.



# PROJECTS

- The course includes **two open-ended projects**. These projects can be completed individually or in groups, and there's no right or wrong answer since students are free to develop the projects in a way they want to. They just have to meet certain constraints and criteria.
- Students will find different solutions and ways to develop the projects, inviting innovation, creativity and problem-solving thinking.



# PROJECTS

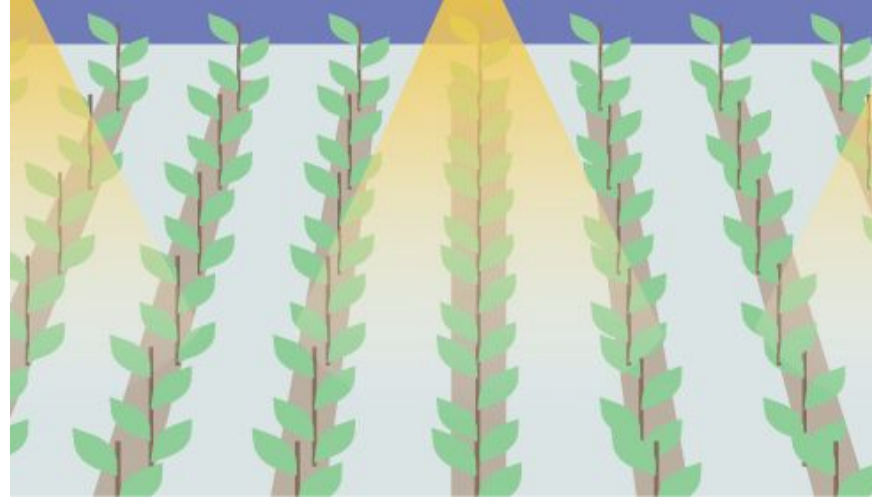
## Lesson 5- 90 mins



Students design, build, and program their own holiday light circuit.



## Lesson 10- 180 mins



Students design, build, and program a climate-control system for a greenhouse.



# LOGBOOK

- The Arduino Student Kit comes with an logbook.
- The logbook is a downloadable PDF with exercises related to the concepts learned during the lessons. Students answer the exercises as a way of reinforcing their newly-learned knowledge.
- The logbook comes with the solutions to the exercises at the end, inviting students to reflect on their answers and mistakes.
- You can print as many copies as needed for your class, and it can be completed either individually or in groups.



# LOGBOOK

## EXERCISES

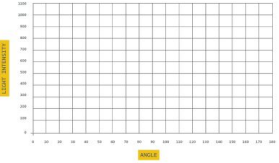


STUDENT  
LOGBOOK

LESSON 9

A. LIGHT INTENSITY EXPERIMENT

Complete this section during the Light Intensity Experiment section of Lesson 9.



Maximum Intensity Angle:



Maximum Intensity:

Why did the maximum light intensity occur at this angle?

24

During the lessons, students will be asked to do exercises as a way of reinforcing what they are learning.

## SOLUTIONS

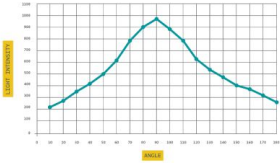


TEACHER  
LOGBOOK

LESSON 9

A. LIGHT INTENSITY EXPERIMENT

Complete this section during the Light Intensity Experiment section of Lesson 9.



Graphs will vary depending on the light in the room and how students hold the servo. Most rooms will have a bell-shaped curve where the brightest light intensity is overhead while the lowest light intensity is at 0 or 180 degrees. Some graphs might have two peaks if there are multiple light sources in the room.

Maximum Intensity Angle: Answers will vary but should be close to 90 degrees.

Maximum Intensity: Answers will vary depending on the light in the room.

Why did the maximum light intensity occur at this angle?

Answers should indicate that the brightest source of light in the room was at that angle. Depending on the room, the light source might be an overhead light, a desk lamp, a computer screen, or a window with sunlight shining through.

24

At the end of the logbook, students will find solutions to the exercises so they can double check their answers and self-reflect.





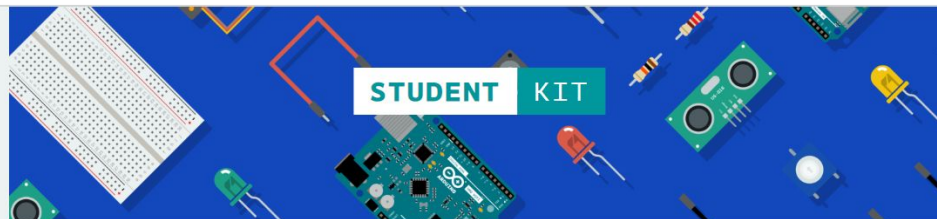


# PLATFORM OVERVIEW

# LANDING PAGE



LESSONS ▾ RESOURCES



Welcome to the Arduino Student kit! In this course you will learn the basics of programming, coding and electronics including current, voltage, and digital logic by discovering inventions that influence the history of technology. Check out our different lessons below and let's begin!

As part of this course, you will be required to work with a **Logbook**. Click on the link below to download it. You can print as many copies as needed.

[↓ DOWNLOAD LOGBOOK](#)

LESSONS ( 11 )




## GETTING STARTED

Welcome! Every journey begins with a first step. For this course, that first step is exploring the tools that you'll use. These tools include the hardware in your kit, the software that controls the hardware, and good safety practices.

[LEARN IT](#)



# INSIDE THE LESSONS

 **STUDENT KIT**

LESSONS ▾ | RESOURCES

LESSON GETTING STARTED

[Introduction](#)

[Invention Spotlight](#)

[What's In The Kit](#)


[Project Board](#)


[The Arduino UNO Board](#)

[Software Setup](#)

[Your First Program – Blink](#)

[Electrical Safety](#)



  
ESTIMATED TIME:  
30 min

## GETTING STARTED

Welcome! Every journey begins with a first step. For this course, that first step is exploring the tools that you'll use. These tools include the hardware in your kit, the software that controls the hardware, and good safety practices.

YOU WILL LEARN ABOUT:

TEAMWORK

ELECTRONICS SAFETY

HARDWARE COMPONENTS



ARDUINO IDE

CODING AND ELECTRONICS

SKILLS

KNOWLEDGE

INTRODUCTION

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# RESOURCES PART 1

## BASICS

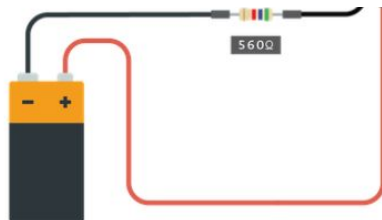
Overview

Vocabulary

Invention Spotlight

Electricity and Circuits

Measuring Electricity



Before you start building your first circuit, check out where **Electricity** comes from.



LEARN MORE ABOUT

ELECTRICITY



1) Locate your project board. This board includes the Arduino board and a circuit breadboard. You will use only the breadboard side of the project board for this activity.



# RESOURCES PART 2

## RESOURCES

Q Electricity

CLOSE

Electrical Theory

### Electricity

#### WHERE DOES ELECTRICITY COME FROM?

**Do This:** Take two minutes and brainstorm all the devices you use on a day-to-day basis that use electricity. How many can you list?

Everything (at least all matter) is made up of tiny particles called atoms. Atoms are made up of even smaller particles called protons, electrons, and neutrons. The number of protons, electrons, and neutrons in an atom determines whether the atom is gold or silver, hydrogen or oxygen, or any of the 118 elements. Protons and neutrons are found in the nucleus (or center) of the atom. Protons have a positive charge, and neutrons have a neutral charge. **Electrons** are found on the outside edges of the atom and have a negative charge. Because electrons are smaller than protons and neutrons and because they are on the outside edges of the atom, they can be passed from one atom to another. This moving charge is where electricity comes from.

Particle	Charge	Location
Proton	Positive (+)	Nucleus (center of atom)
Neutron	Neutral	Nucleus (center of atom)
Electron	Negative (-)	Orbiting the nucleus





**THANK YOU FOR YOUR  
TIME!**

**ANY QUESTIONS?**

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