



## STUDENT KIT

# STUDENT KIT SYLLABUS

\*For the lessons 1-10 you will always need a computer, access to the online platform, Arduino Uno board with mounting base and jumper wires

## LESSON 0: GETTING STARTED

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**DURATION:** 30 min

**LOGBOOK PAGE:** 1

**INVENTION SPOTLIGHT:** The computer

**Description:** Exploring the tools that you will use in this course: the hardware in your kit, the software that controls the hardware, and good safety practices.

**Learn about:** Arduino, Uno board, components and parts included in the kit, Arduino IDE, and electrical safety

**Materials:**

For Getting Started lesson you only need a computer, access to the online platform, Arduino Uno board, and USB cable


## LESSON 1: ELECTRICITY BASICS

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**DURATION:** 90 min

**LOGBOOK PAGES:** 2-3

**INVENTION SPOTLIGHT:** Electricity



**Description:** Build your first circuit and use it to learn about where electricity comes from, how the components in the circuit work together, and how electricity can be measured.

**Learn about:** Electricity and electrical sources, breadboard, conductors and insulators, resistors, LEDs and polarity, and simple circuits.

**Materials\*:**

- 4 x different coloured LEDs
- 560 ohm resistor
- 9V battery + battery snap

## LESSON 2: OHM'S LAW

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**DURATION:** 90 min

**LOGBOOK PAGES:** 4-8

**INVENTION SPOTLIGHT:** Measuring electricity

**Description:** Learn about Ohm's law, build series and parallel circuits and investigate how electrical measurements such as voltage behave in these circuits.

**Learn about:** Ohm's law, multimeters, schematic and wiring diagrams, and series and parallel circuits

**Materials\*:**

- 3 x red LED
- 5 x 220 ohm resistor
- Multimeter + connectors
- 9V battery + battery snap


## LESSON 3: TRAFFIC SIGNALS

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**DURATION:** 90 min

**LOGBOOK PAGES:** 9-10

**INVENTION SPOTLIGHT:** History of the traffic signal



**Description:** Write programs to control the LEDs in the circuit, including a program for a traffic light. Use a multimeter to take electrical measurements of the circuit.

**Learn about:** Circuits, digital and analog inputs and outputs, taking electrical measurements, Arduino IDE, pseudocode, writing programs, programming syntax, debugging, and conditional statements

**Materials\*:**

- 3 x 220 ohm resistor
- 1 x red, yellow and green LED
- 10K ohm resistor
- Pushbutton
- USB cable

## LESSON 4: DIMMER SWITCH

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**DURATION:** 90 min

**LOGBOOK PAGES:** 11

**INVENTION SPOTLIGHT:** The telephone

**Description:** Investigate analog signals and how they can be used to control a circuit. Create an LED circuit that dims the LEDs when you turn a device called a potentiometer.

**Learn about:** Digital and analog circuits, potentiometers, variables, conditional statements, debugging, serial communication, and using a serial monitor

**Materials\*:**

- Potentiometer
- Multimeter
- 3 x 220 ohm resistor
- 3 x blue LED
- USB cable


## LESSON 5: PROJECT - HOLIDAY LIGHTS

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**DURATION:** 180 min

**LOGBOOK PAGES:** 12-17

**INVENTION SPOTLIGHT:** The LED



**Description:** An open-ended project to design, build, and program your own holiday light display.

**Learn about:** Designing and constructing circuits, reusing existing code, debugging, creativity, critical thinking, and problem solving

**Materials\*:**

- 4-8 x LEDs
- Pushbutton
- Potentiometer
- Resistors
- Multimeter
- USB cable

## LESSON 6: SPORTS ROBOT

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**DURATION:** 90 min

**LOGBOOK PAGES:** 18-19

**INVENTION SPOTLIGHT:** Electric motors

**Description:** Use a servo motor to create a simple sports robot. Program the robot to be controlled by you to hit, kick, or throw a ball.

**Learn about:** Electric and magnetic fields, standard servo motors, capacitors, constants and variables, and using libraries and a map function

**Materials\*:**

- Pushbutton
- Servo motor
- Potentiometer
- 100 uF capacitor
- 10K ohm resistor
- Multimeter
- 9V battery + battery snap
- USB cable

## LESSON 7: WINDSHIELD WIPERS

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**DURATION:** 90 min

**LOGBOOK PAGES:** 20

**INVENTION SPOTLIGHT:** Designing a successful invention

**Description:** Work with a servo to create a circuit that simulates a windshield wiper. Add controls to your circuit that will be programmed to change your windshield wiper between different modes.

**Learn about:** Nested conditionals, switch-case structures, and loops

### Materials\*:

- Servo motor
- Potentiometer
- Pushbutton
- 10K ohm resistor
- 100 uF capacitor
- USB cable
- Crafting materials

## LESSON 8: MUSICAL KEYBOARD

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**DURATION:** 90 min

**LOGBOOK PAGES:** 21-23

**INVENTION SPOTLIGHT:** Electronic instruments

**Description:** Use a simple electronic component called a piezo buzzer to produce the sound by causing it to vibrate.

**Learn about:** Piezo buzzer, sound wave period, frequency and pitch, nested conditional statements, arrays, and resistor ladders

### Materials\*:

- Piezo buzzer
- Pushbutton
- 220, 4.7K, 10K ohm resistors
- Multimeter
- USB cable

## LESSON 9: LIGHT WAVE RADAR

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**DURATION:** 90 min

**LOGBOOK PAGES:** 24-25

**INVENTION SPOTLIGHT:** The computer

**Description:** Use your Arduino board and a device called a phototransistor to investigate electromagnetic waves – specifically visible light.

**Learn about:** Phototransistor, electromagnetic wave and spectrum, fiber optics, ASCII code, called function, and controlling a circuit using a serial monitor

**Materials\*:**

- Phototransistor
- Blue LED
- Servo motor
- 220, 10K ohm resistor
- 100 uF capacitor
- USB cable

## LESSON 10: PROJECT - SMART GREENHOUSE

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**DURATION:** 180 min

**LOGBOOK PAGES:** 26-30

**INVENTION SPOTLIGHT:** Beyond Earth's atmosphere

**Description:** An open-ended project to design, build, and program a climate-control system for a greenhouse.

**Learn about:** Designing and constructing circuits, reusing existing code, debugging, creativity, critical thinking, and problem solving

**Materials\*:**

- LEDs
- Servo and capacitor
- Manual controls and sensors
- Piezo buzzer
- Piezo buzzer
- Multimeter
- USB cable