

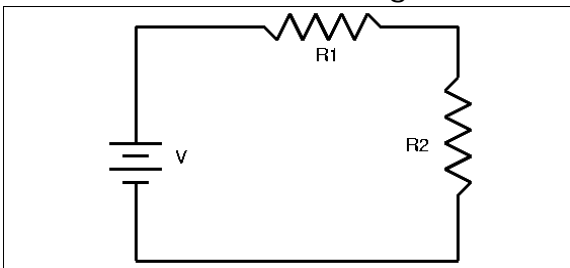
# Electronics Exercises:

## Lessons 1 & 2

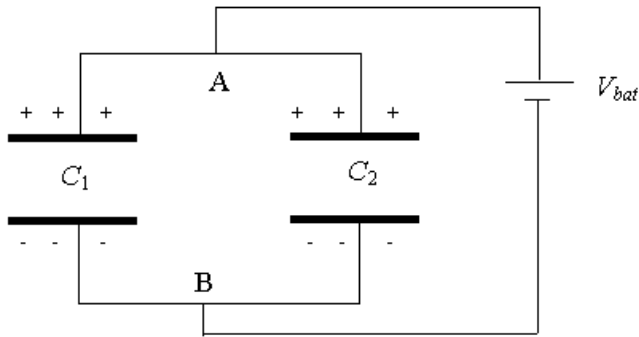
1. Name two different types of power supplies that you can use.
2. If I have a 24 volt light bulb that uses 3 amps, what would happen if I hooked it up to a 1-amp power supply? 1000-amp power supply?
3. What does a transformer do?
4. I need a 5.6k-ohm resistor. What does the resistor color code look like?
5. I need a 2k resistor, but I only have 1k resistors left in my bin. How do I connect them together to make a 2k resistor?
6. Why bother using a capacitor in a circuit?
7. I need a 400 $\mu$ f capacitor, but only have 200 $\mu$ f capacitors in my bin. How do I make a 400 $\mu$ f capacitor?
8. Give examples of where you'd find AC and DC current in everyday life.
9. What's a diode and how do you know which way the electricity flows?
10. What the difference between a microprocessor and microcontroller?
11. What's an IC?
12. Can I substitute one transistor for another?

# Answers to Electronics Exercises: Lessons 1 & 2

1. D-cell battery, AC wall adapter.
2. 1-amp power supply wouldn't light it up (and may damage the power supply), and the 1000-amp power supply would work just fine.
3. A transformer is a component that trades volts for amps and vice-versa. If I put 100 volts at 1 amp into a transformer, it might put out 10 volts at 10 amps.
4. green-glue-red-gold
5. Connect the resistors together in series:



6. Capacitors are used for lots of different things. They can be part of a "filter" circuit that removes unwanted electrical "blips" or signals. For example, radios use capacitors. You see, a radio initially doesn't receive just one FM radio station. No, it receives ALL the stations in your area at once. Then, it has a filter circuit using capacitors to filter out all of the stations except the one that you have the radio tuned to. Capacitors are also used to let AC current pass through them, but not DC.
7. Connect the capacitors together in parallel:



8. AC comes from your wall outlet and DC comes from a battery.

9. A diode is like a one-way valve for electricity. It lets current go through it one way, but not the other. They have two leads, called the **anode** and the **cathode**.



10. A common type of programmable chip is called a **microprocessor**. These are the “brain” of a typical home computer. A cousin of the microprocessor is the **microcontroller**. A microcontroller is like a whole computer on a chip.

11. An integrated circuit, sometimes called an “IC” or a “chip” (as in “computer chip”) is a complete circuit that has been miniaturized and put into a small plastic block with wires coming out of it.

12. Not usually. In our breadboard circuits, however, you may substitute the NPN 2N2222A for a 2N3904. You may also substitute the PNP 2N4403 for a 2N3906. In most cases, the packaging on the outside makes it seem like you can swap one for another, but what’s inside is radically different. (Some that you’ll find aren’t even transistors, but only look like it!)

# Electronics Exercises:

## Lesson 3: Basic Circuits

1. What is a momentary contact switch?
2. What is an LED?
3. What is a piezo buzzer?
4. What is a relay?
5. What is a meter?
6. What is a potentiometer?
7. What is a photoresistor?
8. What is a 555 timer?
9. Using the formula  $R = V / I$  calculate the resistance value of a circuit with 12 volts and 1 amp of current.
10. Using the formula  $I = V / R$ , calculate the current a circuit is using with 12 volts and 100 ohms of resistance.
11. Using the formula  $E = I * R$ , calculate the voltage of a circuit that has a resistance of 100 ohms and is using 150 milliamps of current.
12. What happens if we connect an LED's anode to ground and the

cathode to positive voltage?

13. Why do we use a transformer in the audio experiments using the speaker?
14. What is a voltage divider?
15. What is a seven segment display?
16. What are the two types of transistors?
17. Why do we use transistors in electronics?
18. What is a voltage regulator?
19. What is the full name of an Op-Amp?
20. What does an Op-Amp do?
21. What is a bargraph?

# Answers to Electronics Exercises:

## Lesson 3: Basic Circuits

1. What is a momentary contact switch?

A switch that is only closed while being pressed.

2. What is an LED?

A diode that emits light.

3. What is a piezo buzzer?

A buzzer that converts electricity into sound.

4. What is a relay?

A device that turns on a secondary circuit when the primary circuit activates the relay.

5. What is a meter?

A device that is used to display electrical information so people can visualize the information.

6. What is a potentiometer?

An electrical device that can either divide a voltage and produce a variable voltage output or act as a variable resistor.

7. What is a photoresistor?

A photoresistor that varies its internal resistance based on the amount of light hitting the photoresistor's sensor.

8. What is a 555 timer?

A integrated circuit that can be configured to produce a wide range of output frequencies.

9. Using the formula  $R = V / I$  calculate the resistance value of a circuit with 12 volts and 1 amp of current.

We know that the voltage is 12 volts and the current is 1 amp. So we divide 12 by 1 and that gives us the answer: 12. So the resistance is 12 Ohms. ( $12 = 12 / 1$ )

10. Using the formula  $I = V / R$ , calculate the current a circuit is using with 12 volts and 100 ohms of resistance.

We know that the voltage is 12 volts and the resistance is 100 ohms, so we divide 12 by 100 and that gives us the answer: 0.12, so the current is 0.12 Amps ( $0.12 = 12 / 100$ )

11. Using the formula  $E = I * R$ , calculate the voltage of a circuit that has a resistance of 100 ohms and is using 150 milliamps of current.

We know that the current is .15 amps and the resistance is 100 ohms. So we multiply .15 times 100 and that gives us the answer: 15, so the voltage is 15 volts ( $15 = .15 / 100$ )

12. What happens if we connect an LED's anode to ground and the cathode to positive voltage?

Nothing, the LED will block the flow of current and it will remain off.

13. Why do we use a transformer in the audio experiments using the speaker?

To protect the circuit from excessive current draw, which can and probably will damage components.

14. What is a voltage divider?

A circuit that uses an electronic component (Resistors, Diodes, LEDs) to divide a voltage to a safe level for more sensitive electronic components.

15. What is a seven segment display?

A display that uses 7 LEDs to represent numbers and letters that people can understand.

16. What are the two types of transistors?

NPN (Negative-Positive-Negative) and PNP (Positive-Negative-Positive)

17. Why do we use transistors in electronics?

To protect low current circuits from other circuits that need higher current to operate. And also to amplify signals for devices that need higher strength to operate properly.

18. What is a voltage regulator?

A integrated circuit that takes a higher voltage and reduces it to a set lower voltage. The 7805 voltage regulator in your kit provides a constant 5 volts output from a source voltage of 6 volts to as high as 35 volts.

19. What is the full name of an Op-Amp?

Operational Amplifier

20. What does an Op-Amp do?

Amplifies an input signal for a electronic device or circuit that requires more power.

21. What is a bargraph?

A group of LEDs that are tied together to represent electrical information visually.



# Electronics Exercises:

## Lesson 4: Digital Circuits

1. What is a bit?
2. What is a nibble?
3. What is a byte?
4. What is a logic gate?
5. What is a truth table?
6. If we have a NAND gate with both inputs low, what is the output?
7. If we have an OR gate with both inputs low, what is the output?
8. If we have a NOR gate with both inputs low, what is the output?
9. What is a pull-down resistor?
10. What is a pull-up resistor?
11. How many gates are required to build a digital oscillator?
12. What is a SR Latch?

13. What is an inverter?
14. What is a D type Flip Flop?
15. What is switch bounce?
16. How can we solve switch bounce?
17. What is a seven segment display?
18. Why do we use seven segment displays?
19. What is a binary coded decimal counter?
20. What does a binary coded decimal to seven segment display IC do?

# Answers to Electronics Exercises:

## Lesson 4: Digital Circuits

1. What is a bit?

A bit represents a logic 1 or a logic 0.

2. What is a nibble?

A nibble is a collection of four bits, also called a "four bit word".

3. What is a byte?

A byte is 8 bits or two nibbles.

4. What is a logic gate?

A digital logic device that controls its output based on the values of the gate's inputs.

5. What is a truth table?

A truth table shows us what a digital ICs output should be based on the combination of possible inputs.

6. If we have a NAND gate with both inputs low, what is the output?

High.

7. If we have an OR gate with both inputs low, what is the output?

Low.

8. If we have a NOR gate with both inputs low, what is the output?

High

9. What is a pull-down resistor?

A resistor that is used to force the voltage on a digital input or output to ground.

10. What is a pull-up resistor?

A resistor that is used to force the voltage on a digital input or output to positive voltage.

11. How many gates are required to build a digital oscillator?

2.

12. What is a SR Latch?

A basic digital memory circuit.

13. What is an inverter?

An inverter will output the opposite of what is being input. So if a 1 is on the input of an inverter then the inverter will output a 0.

14. What is a D type Flip Flop?

A memory circuit that can be set, cleared, and also have data clocked in. The D type flip flop also has two outputs, the first is equal to the stored data and the second is the inverted value of the stored data.

15. What is switch bounce?

The electrical noise a switch generates when closing or opening.

16. How can we solve switch bounce?

Capacitors can be used to absorb the “electrical noise” from a switch.

17. What is a seven segment display?

A group of seven LEDs arranged to form a pattern in the shape of the number eight.

18. Why do we use seven segment displays?

To translate computer data into information people can easily understand.

19. What is a binary coded decimal counter?

An IC that counts like we do, but stores the data in binary.

20. What does a binary coded decimal to seven segment display IC do?

It takes the BCD data from a counter (or other source) and converts it to the data a seven segment display needs to display numbers people can understand.