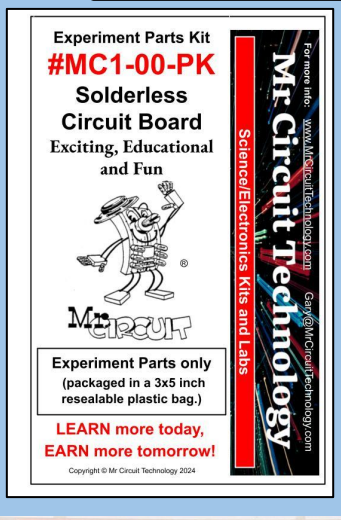
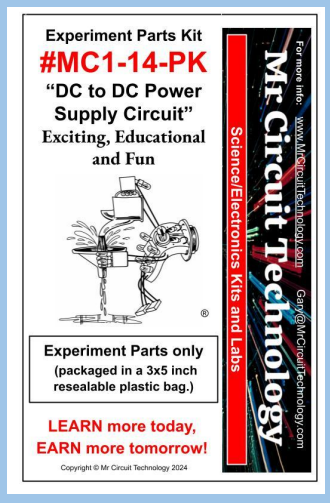
For more info: www.MrCircuitTechnology.com Gary@MrCircuitTechnology.com

Mr Circuit Technology

Science/Electronics Experiment Kits and Labs

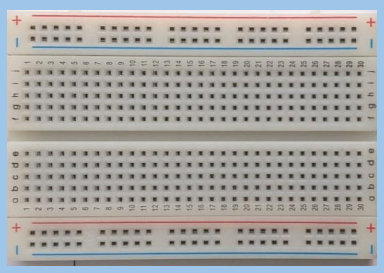
Exp. 14 - "0 TO 9V DC POWER SUPPLY CIRCUIT"

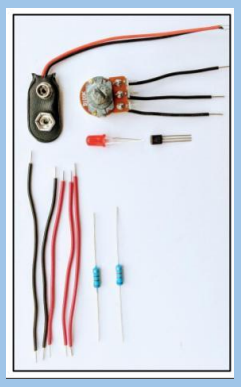




LESSON PLAN

Table of Contents





PREPARATION: You can put the Page 12 poster up on your classroom wall to announce the fact that you are going to do the Science-Electronics Experiment.

Step 1 - Make a copy of pages 1 through 8 for each student. The students can read and do these pages on their own or you can guide them.

Step 2 - Hand out Parts Kit #MC1-00-PK (that has the Solderless Circuit Board) and Parts Kit #MC1-14-PK (that has the experiment parts) with a 9-Volt battery. Give these items to each student along with the 8 pages.

Step 3 - When your students have completed the experiment, collect all the Parts Kits and batteries for later use.

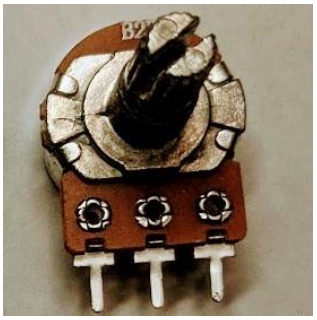
Step 4 - Collect all the Written Quizzes for grading and use the Answer Key to grade them.

For Tech Support or any questions, you can email us or call 805-295-1642

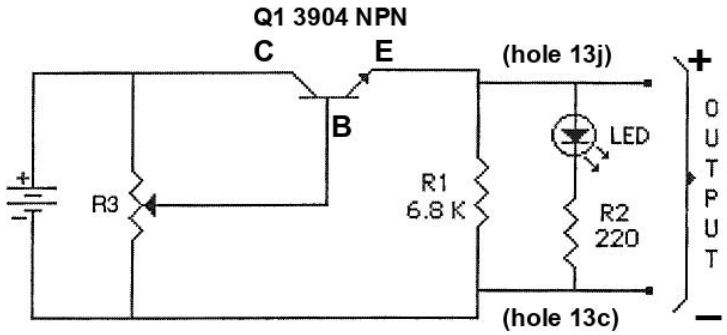
EXPLANATION OF EXPERIMENT part 1 of 2

*** You are going to build a variable power supply circuit that will put out from 0 to 9VDC, 0 to 50mA. Here is the SCHEMATIC DIAGRAM of the circuit you will build.

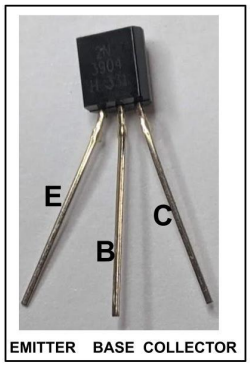
POTENTIOMETER



SCHEMATIC DIAGRAM



R1: 6.8 K (Blue, Gray, Red, Gold).
R2: 220 ohm (Red, Red, Brown, Gold).
R3: 100K Potentiometer.
Q1: 2N3904 (NPN)



This interesting circuit was invented by engineers who needed a circuit that would have an input of a fixed 9 volts DC and **output of a variable DC voltage** of between 0 and 9 volts DC between 0 and a current output of between 0 and 50 milliamps..

(**50 milliamps** = 50mA = 0.050 Amps)

This circuit uses a Potentiometer with an NPN Bipolar Transistor to vary the voltage.

The LED in the circuit tells you the power supply is working and is brighter as the voltage increases.

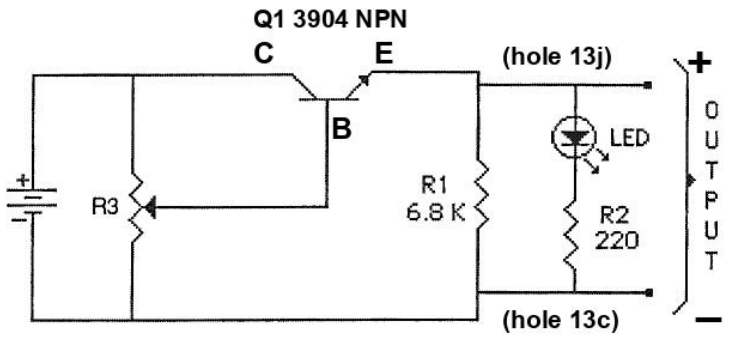
You can use this power supply **to power portable transistor radios** that run on 4 to 9 VDC and needs about 30 milliamps to operate.

(Continue to Page 2)

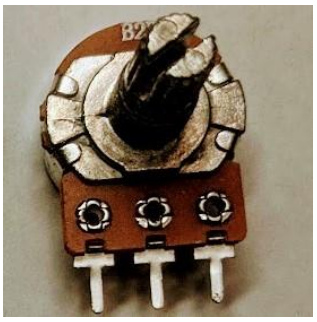
EXPLANATION OF EXPERIMENT part 2 of 2

Let's talk about how the circuit works. Here is the schematic of the 0 to 9V DC Power Supply circuit that you will build. **(Also called a DC to DC Power Supply.)**

SCHEMATIC DIAGRAM



POTENTIOMETER



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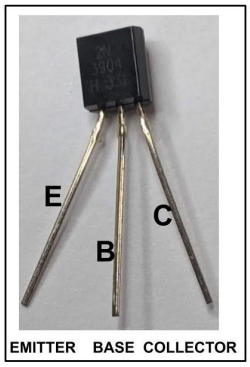
R3: 100K Potentiometer.
Q1: 2N3904 (NPN)



In this circuit, transistor Q1 is used as **an adjustable resistor.** The Potentiometer **controls the voltage applied to the BASE of the transistor**. The voltage applied to the BASE of the transistor controls **its internal resistance** between the COLLECTOR and the EMITTER.

The output of this variable DC Power Supply will be the **maximum when the BASE of the transistor is close to ZERO volts and at minimum when the BASE is high.**

The voltage across the resistor R1 is the output voltage. It has a positive and negative terminal. This is where you connect the output of this power supply to any device that requires a voltage up to 9V DC.

You can use a multimeter to measure the output voltage and current.

(Continue to Page 3)

MC1-14-R-3

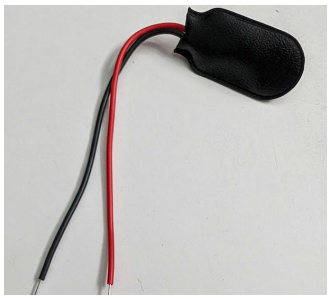
PURPOSE OF THIS EXPERIMENT

*** To BUILD A 0 TO 9V DC POWER SUPPLY CIRCUIT USING A TRANSISTOR AND A POTENTIOMETER.

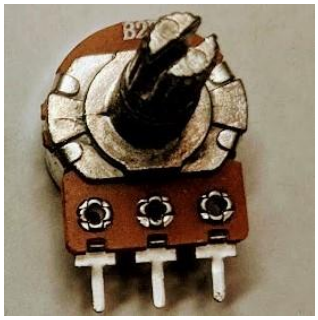
PARTS NEEDED FOR EXPERIMENT

In this experiment, you will use

a BATTERY SNAP



a POTENTIOMETER



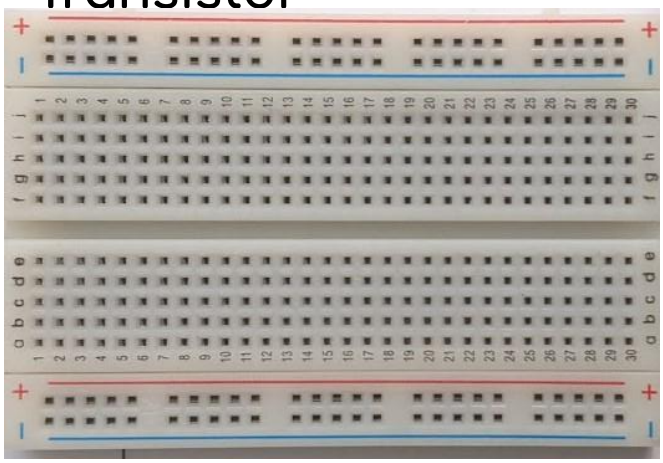
one LED

220 Ohm resistor

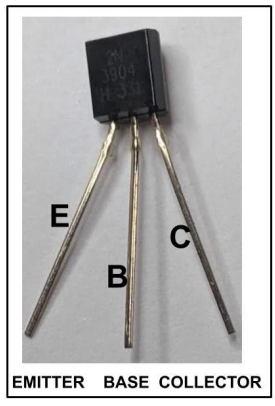
6.8k Ohm resistor

5 Jumper Wires

a SOLDERLESS CIRCUIT BOARD



an NPN Transistor



You will also need a good 9 Volt battery

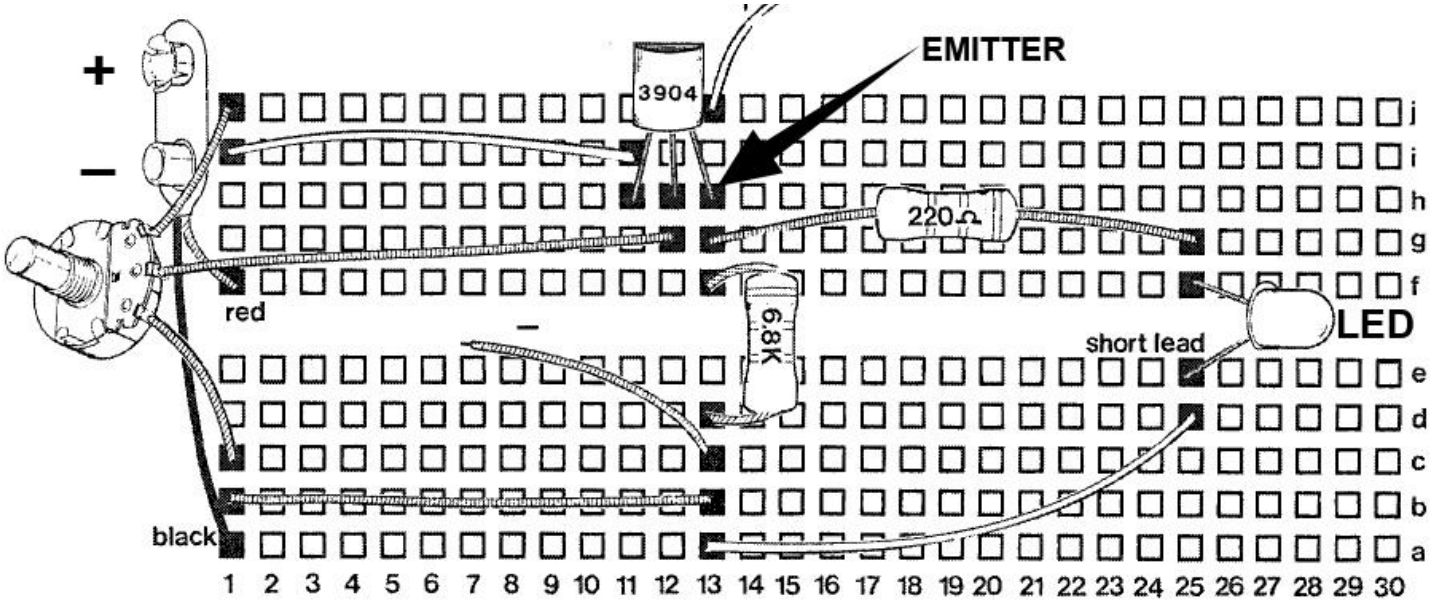
(Continue to Page 4)

MC1-14-R-4

DO THE EXPERIMENT (part 1 of 2)

Now you are going to build the circuit on a Solderless CB.

Step 1 - Take out all the parts needed for this experiment.

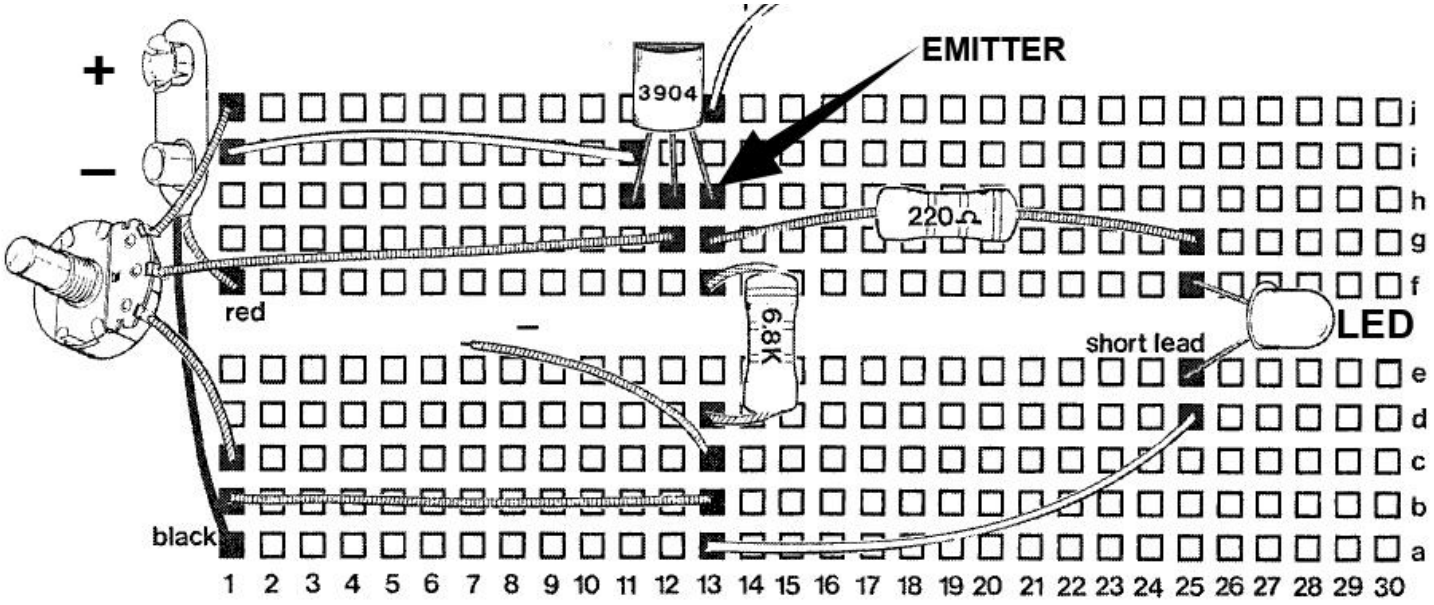


Step 2 - Install all the parts on the SCB as shown above.

- ❑ Install an LED with the Short Lead in hole 25e and the Long Lead in hole 25f
- ❑ Install the 220 Ohm resistor (red, red, brown, gold) in holes 13g to 25g
- ❑ Install the 6800 (6.8k) Ohm resistor (blue, gray, red, gold) in holes 13d to 13f
- ❑ Install the NPN 3904 Transistor - Emitter in 13h, Base in 12h, Collector in 11h
- ❑ Install the Potentiometer, edge lead in 1c, middle lead in 12g, other edge in 1j
- ❑ Install Jumper Wire #1 in holes 1i to 11i
- ❑ Install Jumper Wire #2 in holes 1b to 13b
- ❑ Install Jumper Wire #3 in holes 13c and loose end
- ❑ Install Jumper Wire #4 in holes 13a to 25d
- ❑ Install Jumper Wire #5 in holes 13j and loose end
- ❑ Install the Battery Snap, Black lead in hole 1a and Red Lead in hole 1f

(Continue to Page 5)

DO THE EXPERIMENT (part 2 of 2)



Step 3 - Connect the battery to the Battery Snap. Adjust the Potentiometer back and forth and observe the LED. The LED is an indicator of the output voltage and you should see it getting brighter and dimmer indicating the output voltage is changing.

You can connect the output to a voltmeter to see the actual voltage it is putting out.

CONCLUSION

You should have observed that you can build a variable output 0 to 9V DC Power Supply with a transistor and potentiometer.

You can use this power supply with electronic projects requiring up to 9V DC.

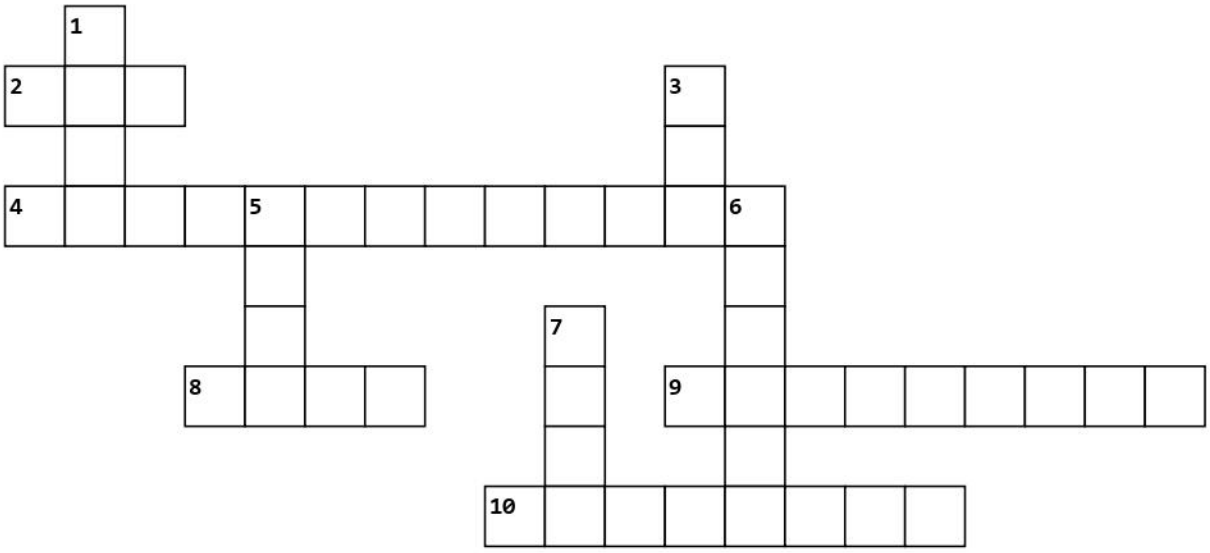
(End of Experiment 11)

Mr. CIRCUIT®

MC1-14-CW

CROSSWORD

Exp. 14 - "0 TO 9V DC POWER SUPPLY CIRCUIT"



Across

2. We use an _____ to indicate there is output voltage from the power supply.

4. What component do you adjust to change the output voltage of this power supply circuit?

8. What is the minimum output voltage of this power supply?

9. What does mA stand for?

10. The transistor in this circuit is used as a variable _____ .

Down

1. This power supply circuit will put out the maximum voltage when the voltage on the BASE of the transistor is _____ .

3. How many transistors does this power supply use?

5. What is the input voltage for this power supply?

6. This power supply is ideal for small transistor _____ .

7. The Potentiometer varies the voltage on the _____ of the transistor.

Mr. CIRCUIT®

MC1-14-WS

WORD SEARCH

Exp. 14 - "0 TO 9V DC POWER SUPPLY CIRCUIT"

H X E D T P X E E O Z Z C T L T E K W Q
A Q O S R F O Y H M A D V O R H K V Z G
E J T R S B E Y R S R D Y M E I P V S D
C J H P I Y A H X I E R B G T J A J S F
G K M Z O D Y A S Y T Q M T E D N G Q Z
K A E C D T M B Z L T L S F M M C Q L P
W V L Z U F E Q A F I F P H O V L K N Q
O V F A I L D N Q S M O L N I C D M I L
I Q S V E H K T T Y E P S Y T F Y H I M
M D H S G R S X T I Q R S C N C V X Q E
W Q K U Q N P C O B O B W E E S H Y H H
G M C T Y P M C Y N R M L W T I U M Z P
M F G V W N A Z L B E T E E O D I P I M
Y K K V L O I I L A Y R T T P B W V M H
O S W H L T L K K B U R S O E Z W O T G
V H T H H E L D F Q E M E W L R R J T S
O I O E D G I V J C I R K M T T I K D Z
Z Z N D Y M M L U Y M M A S L D M C K B
B I E H C K X Q F J R Z B R G V V V A A
E K X I J L D Q M D C U X U X L Q P P U

1. How many fixed value resistors does this power supply circuit use?

2. How many NPN transistors does this power supply circuit use?

3. What kind of voltage does this power supply output, AC or DC?

4. What component do you adjust in this circuit to vary the output voltage?

5. 50mA is the same as 50 _____ .

6. The Potentiometer controls the voltage on the _____ of the transistor.

7. The voltage on the BASE of the transistor controls the internal resistance between the COLLECTOR and the _____ .

8. How many LEDs are used in this circuit? **9.** In this circuit, resistor R3 is a _____ .

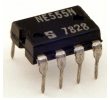
10. The transistor in this circuit is an NPN or a PNP?

(Student Name) (Period/Student Number) (Date)

QUIZ for Exp 14 or STEM KIT #14 in the Mr Circuit Electronics Training Lab 1

(Page 8)

This Quiz covers the training learned by completing STEM Kit #14



"Build a 0 TO 9V DC Power Supply Circuit" Experiment 14

Circle the letter for your answer to each question and then hand this quiz in to your teacher.

A B C D

#1 This circuit has an input of a fixed DC voltage and an output of _____?

A. a variable DC voltage
B. an AC voltage
C. a voltage higher than the input voltage
D. a voltage from -5V to 5V

A B C D

#2 What is the maximum current that can be provided by this DC to DC Power Supply?

A. 10 milliamps
B. 3 Amps
C. 50 milliamps
D. 1 Amp

A B C D

#3 You can use this power supply to supply voltage for _____ .

A. portable transistor radios
B. large HAM radios
C. large Televisions and Stereos
D. microwave ovens

A B C D

#4 In this circuit, transistor Q1 is used as _____?

A. a capacitor
B. an inductor
C. a fixed capacitance
D. an adjustable resistor

A B C D

#5 In this circuit, the potentiometer is used to _____ .

A. vary the output voltage
B. adjust the capacitance
C. as a variable inductor
D. keep the LED from burning out

A B C D

#6 The voltage applied to the base of the transistor controls the _____ of the transistor.

A. external capacitance
B. internal resistance
C. external resistance
D. internal capacitance

A B C D

#7 The potentiometer controls the voltage applied to the _____ of the transistor.

A. Collector
B. Emitter
C. Anode
D. Base

A B C D

#8 The output of this DC to DC Power Supply will be a maximum when the _____ of the transistor is close to 0 volts.

A. current applied to the Collector
B. voltage applied to the Base
C. voltage applied to the Emitter
D. current applied to the Base

A B C D

#9 When the _____ of transistor Q1 is high, the output voltage will be at minimum.

A. external capacitance
B. internal capacitance
C. external resistance
D. internal resistance

A B C D

#10 In this circuit, the brightness of the LED is an indicator of the _____ .

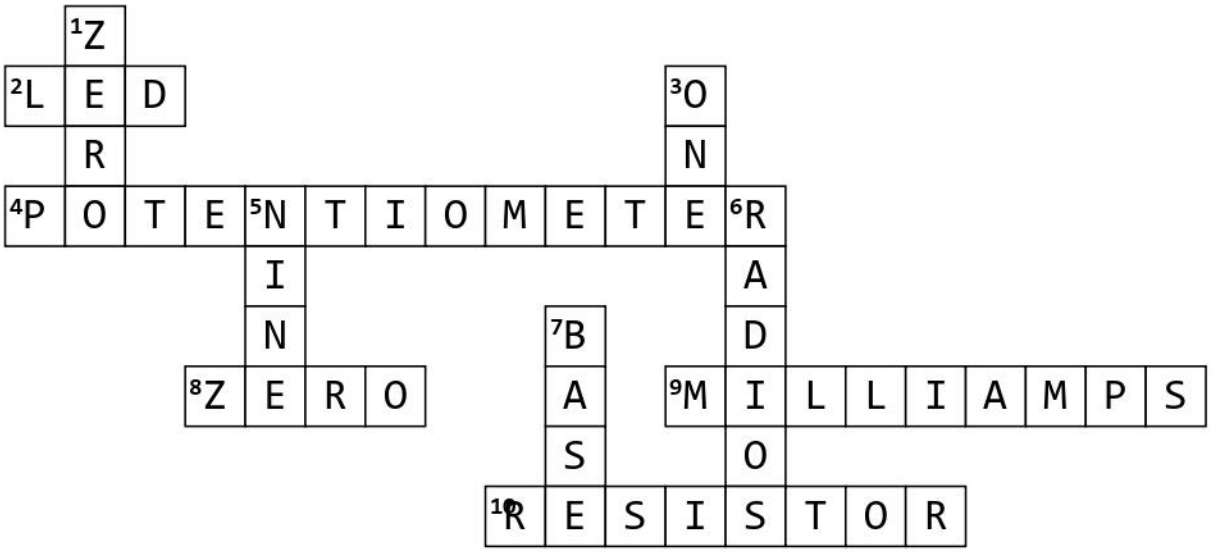
A. output voltage
B. input voltage
C. input current
D. output capacitance

(Form SQ14)

Score	

ANSWERS FOR CROSSWORD

Exp. 14 - "0 TO 9V DC POWER SUPPLY CIRCUIT"



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ANSWERS FOR WORD SEARCH

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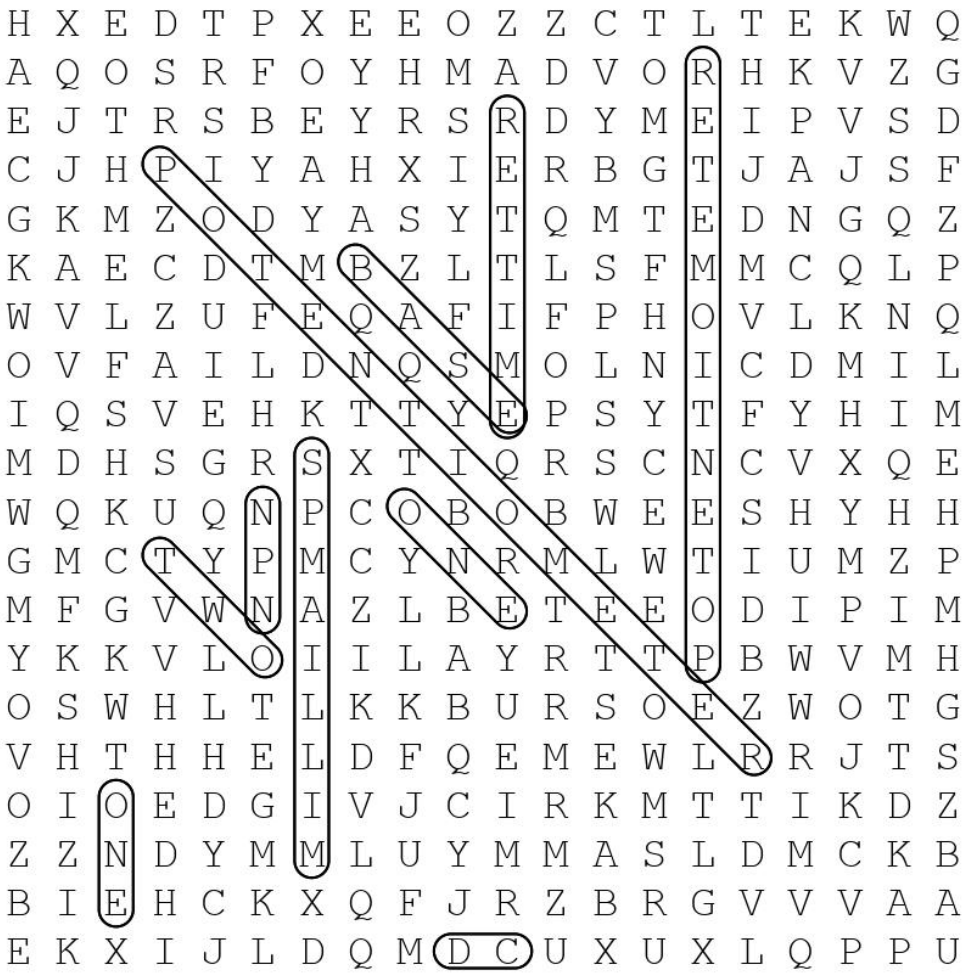

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5. 50mA is the same as 50 _____ .

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8. How many LEDs are used in this circuit? **9.** In this circuit, resistor R3 is a _____ .

10. The transistor in this circuit is an NPN or a PNP?

QUICK-CHECK ANSWER KEY for Experiment 14 QUIZ
for Mr Circuit Electronics Training ("0 TO 9V DC Power Supply")

Place this sheet over top of the STUDENT QUIZ (offset a little to the left and then offset to the right) to compare the answers on this sheet to the answers that the student marked. Put an 'X' for each wrong answer.

Count the right answers and record the score of right answers in your grade book.

A B C D

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C. external resistance
D. internal resistance

A B C D

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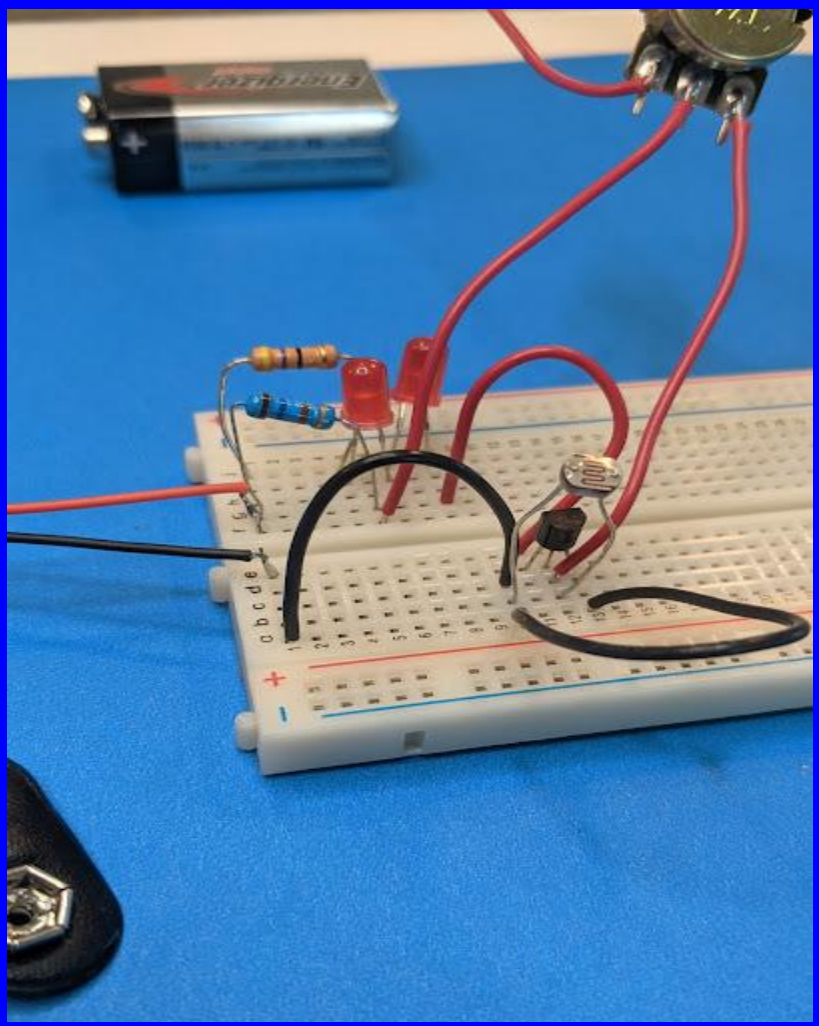
A. output voltage
B. input voltage
C. input current
D. output capacitance

(Form SQAK14)

BUILD A BETTER FUTURE by UNDERSTANDING SCIENCE-ELECTRONICS

0 TO 9V DC POWER SUPPLY

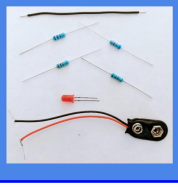


BASIC ELECTRONICS LAB 1

"0 TO 9V DC POWER SUPPLY"

(Poster MC1-14-P01)

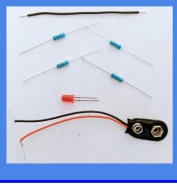
MC1-01
Electronic Parts



For more info: www.MrCircuitTechnology.com MrCircuit23@gmail.com

Mr Circuit Technology

MC1-01
Electronic Parts



PRICE LIST May 2024

PRICE LIST

PARTS KIT Number	Mr Circuit Series 1 SCIENCE / ELECTRONICS "PARTS KITS"	Price Each
MC1-00-PK	Solderless Circuit Board to build kits	$3.95
MC1-01-PK	Parts Kit for "How a Resistor Works	$1.95
MC1-02-PK	Parts Kit for "How a Potentiometer Works	$2.95
MC1-03-PK	Parts Kit for "How a Photocell Works	$1.95
MC1-04-PK	Parts Kit for "How a Capacitor Works	$2.95
MC1-05-PK	Parts Kit for "How a Speaker Works	$2.95
MC1-06-PK	Parts Kit for "How a Diode Works	$1.95
MC1-07-PK	Parts Kit for "How an SCR Works	$3.95
MC1-08-PK	Parts Kit for "How an NPN Transistor Works	$2.95
MC1-09-PK	Parts Kit for "How a PNP Transistor Works	$2.95
MC1-10-PK	Parts Kit for "How a Transistor Oscillator Works	$3.95
MC1-11-PK	Parts Kit for "How a 555 Timer IC Works	$2.95
MC1-12-PK	Parts Kit for "Burglar Alarm circuit	$3.95
MC1-13-PK	Parts Kit for "Solar-Activated Night Light circuit	$3.95
MC1-14-PK	Parts Kit for "DC to DC Power Supply circuit	$2.95
MC1-15-PK	Parts Kit for "Electronic Metronome circuit	$4.95
MC1-16-PK	Parts Kit for "Electronic Motorcycle circuit	$3.95
MC1-17-PK	Parts Kit for "Railroad Lights circuit	$2.95
MC1-18-PK	Parts Kit for "Variable Speed Lights circuit	$3.95
MC1-19-PK	Parts Kit for "Continuity Tester circuit	$4.95
MC1-20-PK	Parts Kit for "Audio Generator circuit	$5.95
MC1-21-PK	Parts Kit for "Electronic Police Siren circuit	$4.95
MC1-22-PK	Parts Kit for "Solar-Activated Wake-Up Alarm circuit	$3.95
MC1-23-PK	Parts Kit for "Variable Timer circuit	$3.95
MC1-24-PK	Parts Kit for "Moisture Detector circuit	$2.95
MC1-25-PK	Parts Kit for "Code Oscillator circuit	$4.95
MC1-26-PK	Parts Kit for "Audible Water Detector circuit	$4.95
MC1-27-PK	Parts Kit for "English Police Siren circuit	$4.95
MC1-28-PK	Parts Kit for "Electronic Canary circuit	$7.95
MC1-29-PK	Parts Kit for "fantasy Space Machine Gun circuit	$5.95
MC1-30-PK	Parts Kit for "Ultrasonic Pest Repeller circuit	$5.95
Set-MC1-PK	**Complete Set of All Series 1 Parts Kits (31 total)**	**$120.00**