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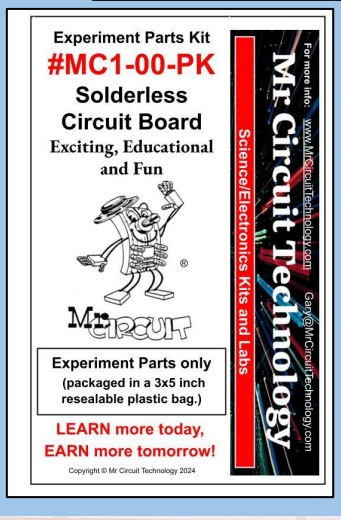
Mr Circuit Technology

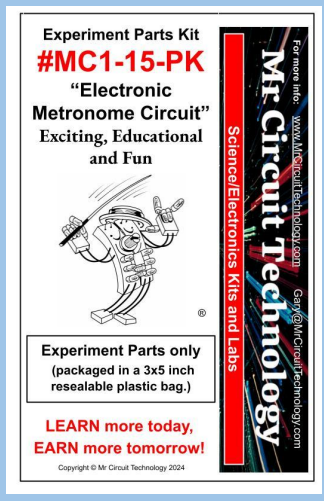
Science/Electronics Experiment Kits and Labs

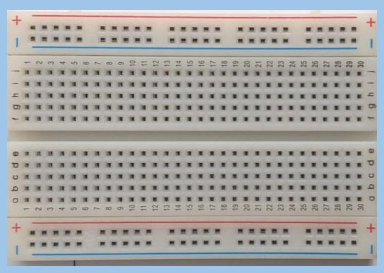
Exp. 15 - "ELECTRONIC METRONOME CIRCUIT"

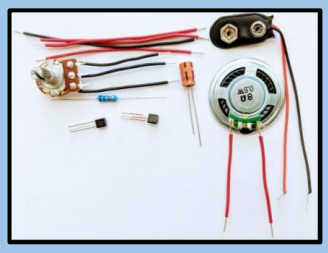


LESSON PLAN

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 #MC1-15-PK (that has the experiment parts) with a 9-Volt battery. Give these items to each student along with the 8 pages.

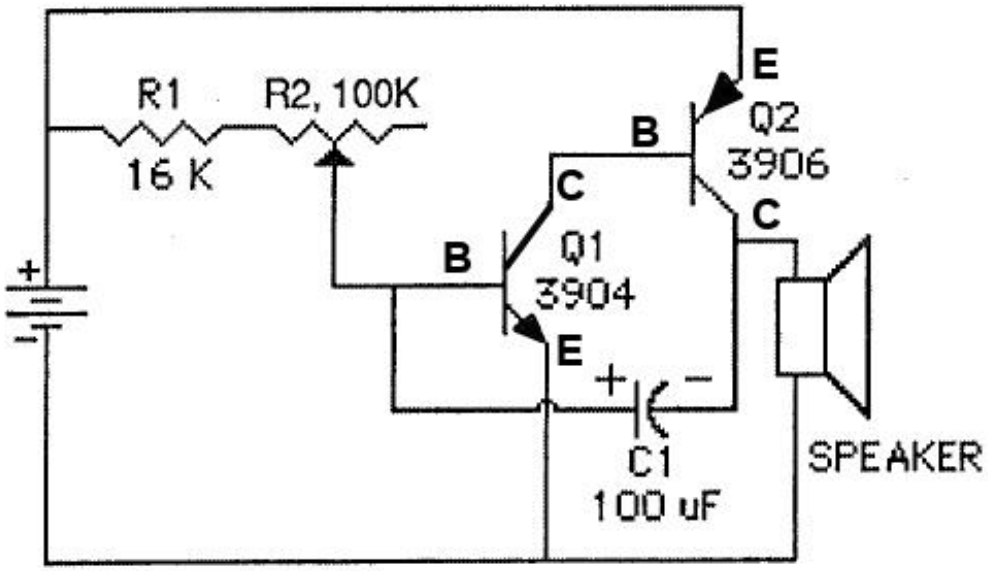
Step 3 - When your students have completed the experiment, collect all the Parts Kits and batteries for later use.

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 an ELECTRONIC METRONOME CIRCUIT. Here is the SCHEMATIC DIAGRAM of the circuit you will build.



This interesting circuit was invented by engineers who needed a circuit that would make a clicking sound like a mechanical metronome.

Traditional metronomes are mechanical and use a swinging arm to adjust the speed.

You may have seen one. They have a weight that is moved up and down the arm to adjust the speed.

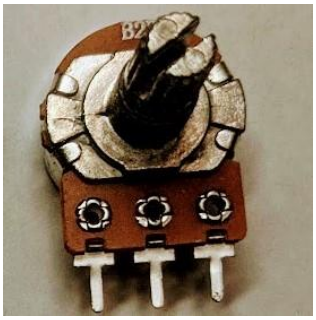
This Metronome circuit is a low-frequency two-transistor oscillator. It uses a Potentiometer to adjust the speed (frequency) of the OSCILLATION or clicks. By rotating the shaft of the Potentiometer the speed of the clicking sound will change.

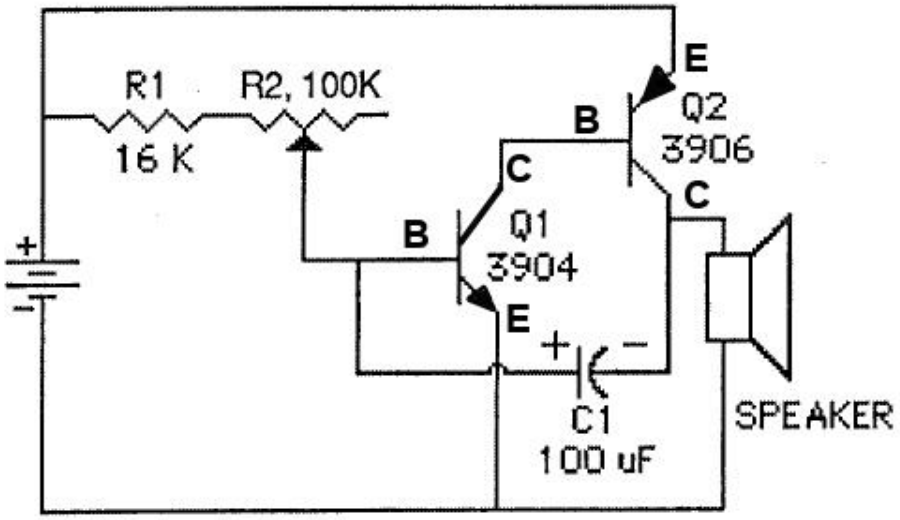
(Continue to Page 2)

EXPLANATION OF EXPERIMENT part 2 of 2

Let's talk about how the circuit works. Here is the schematic of the **ELECTRONIC METRONOME** circuit that you will build.

POTENTIOMETER





This circuit is an adjustable two-transistor oscillator similar to the circuit used in Mr Circuit Experiment 10.

Capacitor C1 charges and discharges at a rate varied by the value of the resistance of Potentiometer R2.

The clicks will be the fastest when the Potentiometer R2 is adjusted to zero Ohms. As you twist the shaft from the zero Ohm position to higher Ohms, the clicking rate will slow down.

You can use this circuit to keep time to the music like you would with a standard mechanical metronome.

(Continue to Page 3)

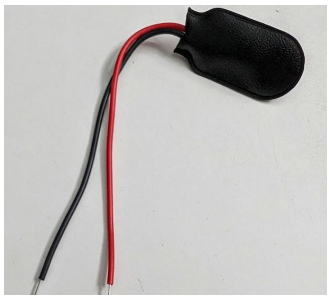
PURPOSE OF THIS EXPERIMENT

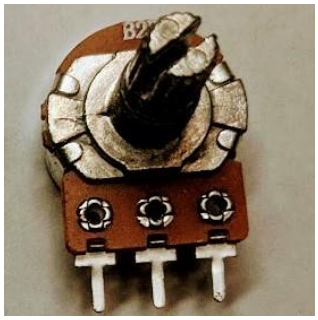
*** To build an ELECTRONIC METRONOME using two bipolar transistors and a potentiometer..

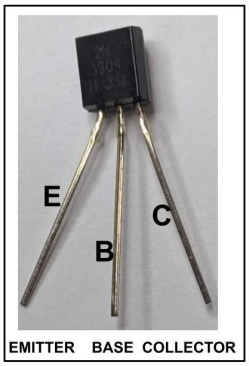
PARTS NEEDED FOR EXPERIMENT

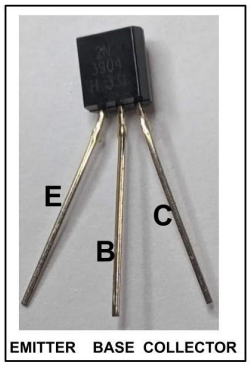
In this experiment, you will use the following items:

a BATTERY SNAP a POTENTIOMETER PNP & NPN





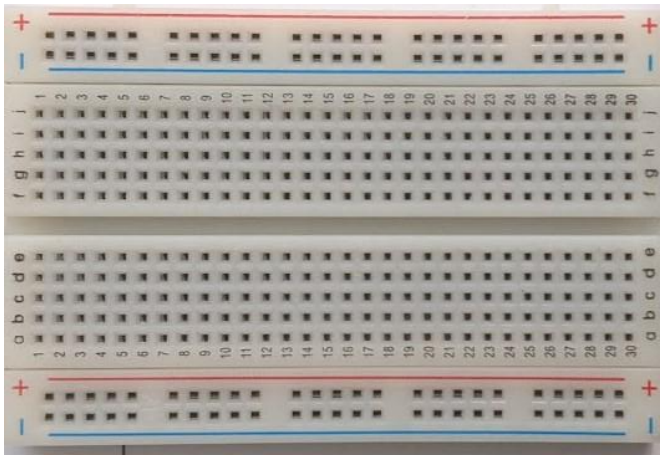


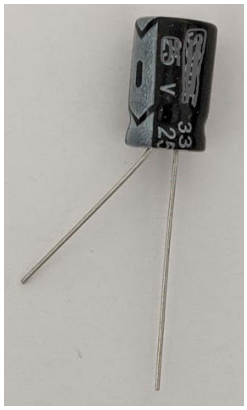


16k Ohm resistor

4 Jumper Wires

a SOLDERLESS CIRCUIT BOARD a Radial Capacitor





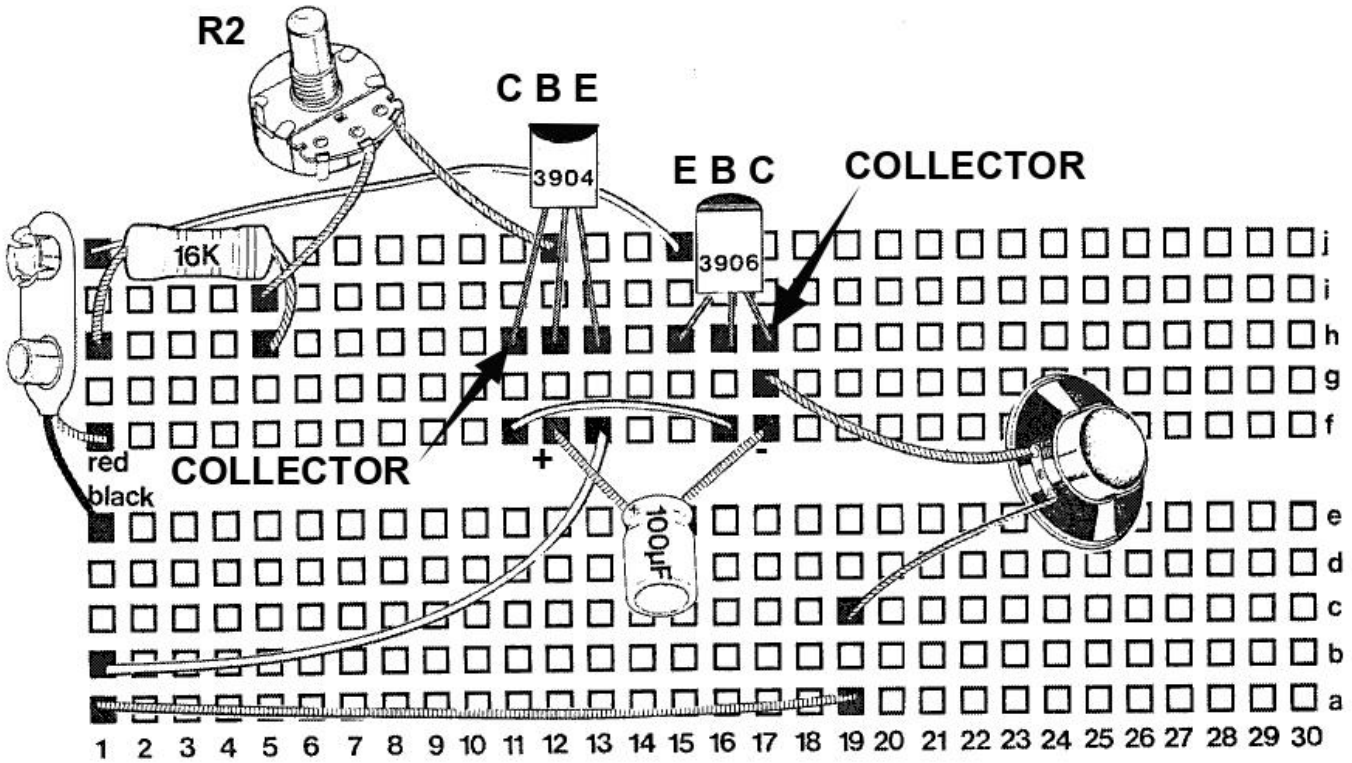
You will also need a good 9 Volt battery

(Continue to Page 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.

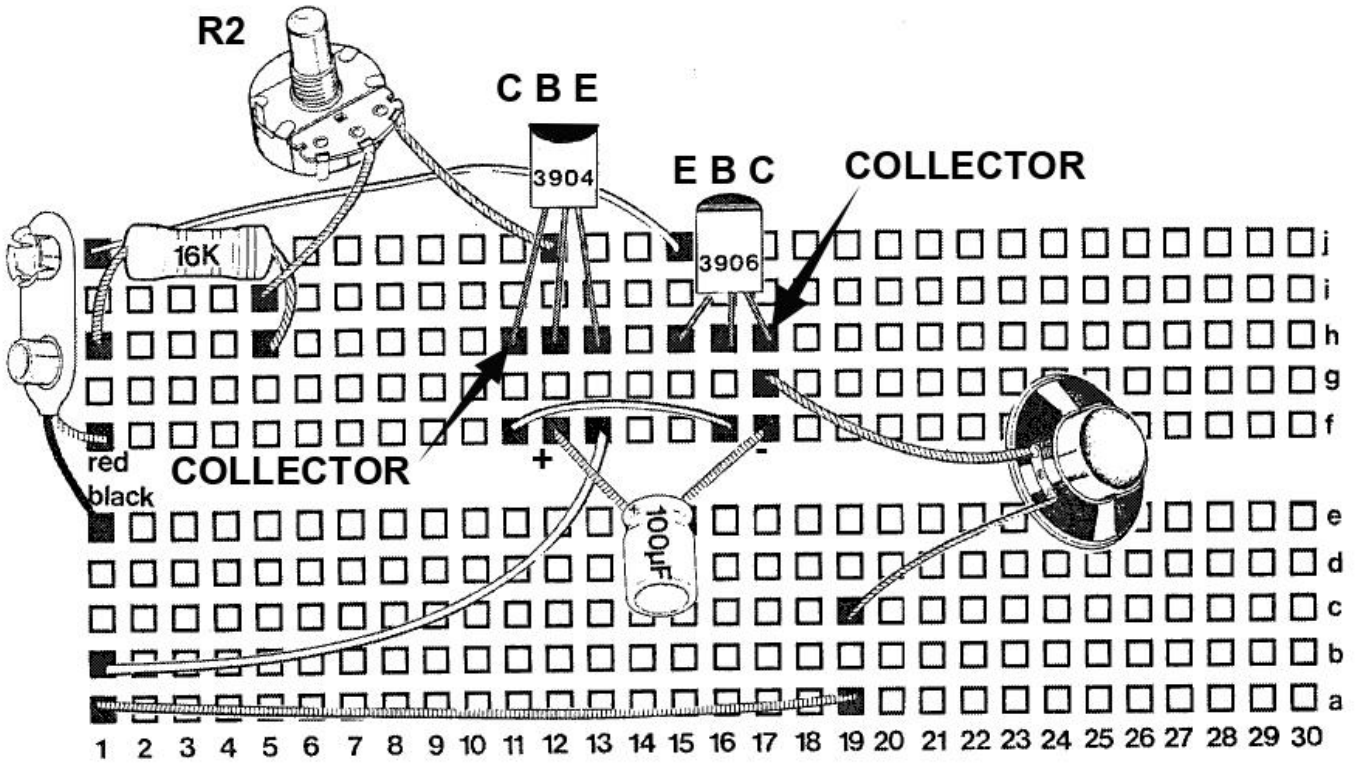


Step 2 - Install all the parts on the SCB as shown above.

- ❑ Install one 16k Ohm resistor (brown, blue, orange, gold) in holes 1h to 5h
- ❑ Install one NPN 3904 Transistor - Collector in 11h, Base in 12h, Emitter in 13h
- ❑ Install one PNP 3906 Transistor - Emitter in 15h, Base in 16h, Collector in 17h
- ❑ Install one 100uF Capacitor long lead in hole,12f, short lead in hole 17f
- ❑ Install the Potentiometer, middle lead in 5i, other edge in 12j
- ❑ Install Jumper Wire #1 in holes1a to 19a
- ❑ Install Jumper Wire #2 in holes 1b to 13f
- ❑ Install Jumper Wire #3 in holes 1j to 15j
- ❑ Install Jumper Wire #4 in holes 11f to 16 f
- ❑ Install the Battery Snap, Black lead in hole 1e and Red Lead in hole 1f

(Continue to Page 5)

ELECTRONIC METRONOME CIRCUIT



Step 3 - Connect the battery to the Battery Snap. Adjust the Potentiometer back and forth and you should hear clicking in the speaker vary from very slow to fast.

CONCLUSION

You should have observed that you can build an ELECTRONIC METRONOME circuit with two transistors and potentiometer.

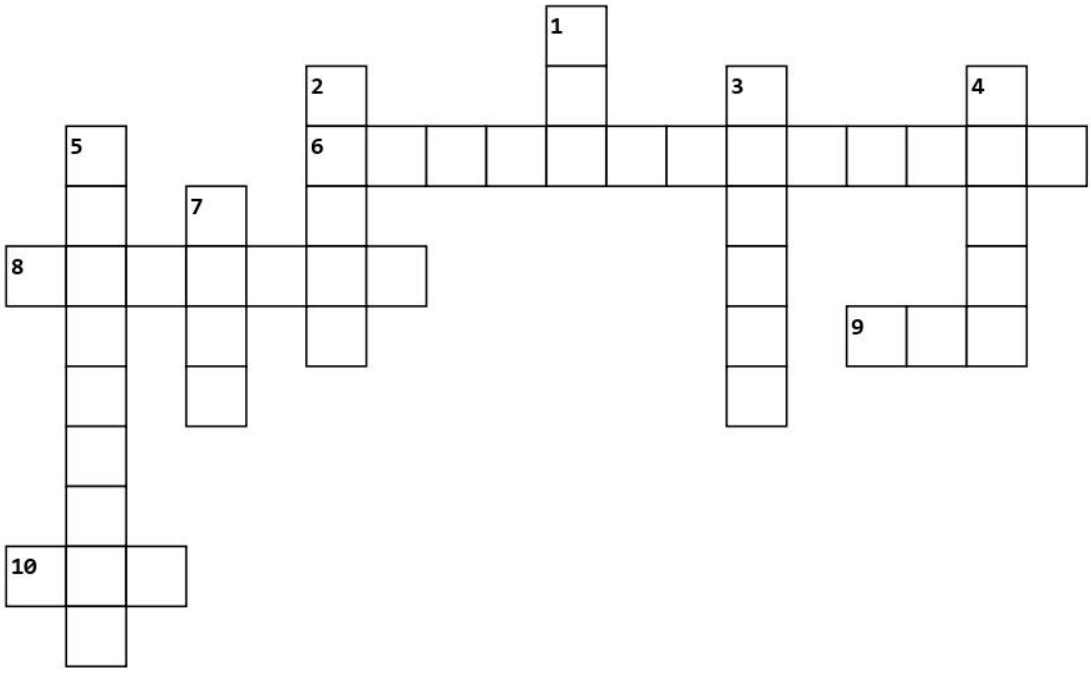
(End of Experiment 11)

Mr. CIRCUIT®

MC1-15-CW

CROSSWORD

Exp. 15 - "ELECTRONIC METRONOME CIRCUIT"



Across

6. The speed of this two-transistor oscillator is controlled by the _____ .

8. The clicking sound of this oscillator comes from the _____ .

9. This circuit uses _____ bipolar transistors.

10. This circuit is a _____ speed two-transistor oscillator.

Down

1. Transistor Q1 is what type of transistor, NPN or PNP?

2. The potentiometer is used to adjust the _____ of the oscillator.

3. To adjust the Potentiometer, you _____ its shaft.

4. What is another word that can be used for the word speed of the oscillator?

5. The value of the _____ in this circuit is 100 microfarads or 100 uF.

7. The Collector pin of Q1 is connected to the _____ of transistor Q2.

Mr. CIRCUIT®

MC1-15-WS

WORD SEARCH

Exp. 15 - "ELECTRONIC METRONOME CIRCUIT"

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

1. A device that makes clicking sounds for setting the music tempo.

2. The electronic component we use to adjust the speed of the oscillation of this circuit.

3. We used two of these in this oscillator circuit.

4. This circuit is a two-transistor _____ .

5. This word is the same as speed or tempo.

6. The _____ makes a clicking sound.

7. The _____ charges and discharges in this circuit.

8. This circuit is powered by a nine volt _____ .

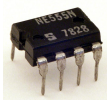
9. This is connected to the the 9-volt battery to give power to the circuit.

10. The Collector of transistor Q1 is connected to the _____ of transistor Q2.

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

QUIZ for Exp 15 or STEM KIT #15
in the Mr Circuit Electronics Training Lab 1

(Page 8)



This Quiz covers the training learned by completing

"Build an Electronic Metronome Circuit" Experiment 15

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

#1 This metronome circuit is built using _____ .

A. a 555 Timer IC
B. a two-transistor oscillator
C. an SCR
D. a quad amplifier

#2 The potentiometer is used to adjust the _____ .

A. the current through the speaker
B. the capacitance of the transistors
C. the loudness of the speaker
D. speed of the oscillation

#3 The Emitter of transistor Q1 is connected to the _____ of transistor Q2.

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

#4 The potentiometer varies the _____ on the Base of transistor Q1.

A. voltage
B. capacitance
C. resistance
D. current

#5 As you adjust the potentiometer from 0 Ohms to its maximum Ohms, the oscillator will _____ in speed.

A. decrease
B. increase
C. remain the same
D. not be affected

#6 In this circuit, the speaker is connected to the _____ of transistor Q2.

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

#7 Transistor Q1 in this circuit is _____ .

A. a PNP Transistor
B. an NPN Transistor
C. a variable diode
D. a capacitance

#8 Based on your understanding of a two-transistor oscillator circuit, the purpose of Capacitor C1 is to _____ .

A. reduce the current in the circuit
B. help control the speed of the oscillator
C. reduce the resistance of the circuit.
D. reduce the voltage used in the circuit

#9 The _____ of Q2 is connected directly to the positive of the battery.

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

#10 The positive lead on Capacitor C1 is connected to the _____ of transistor Q1.

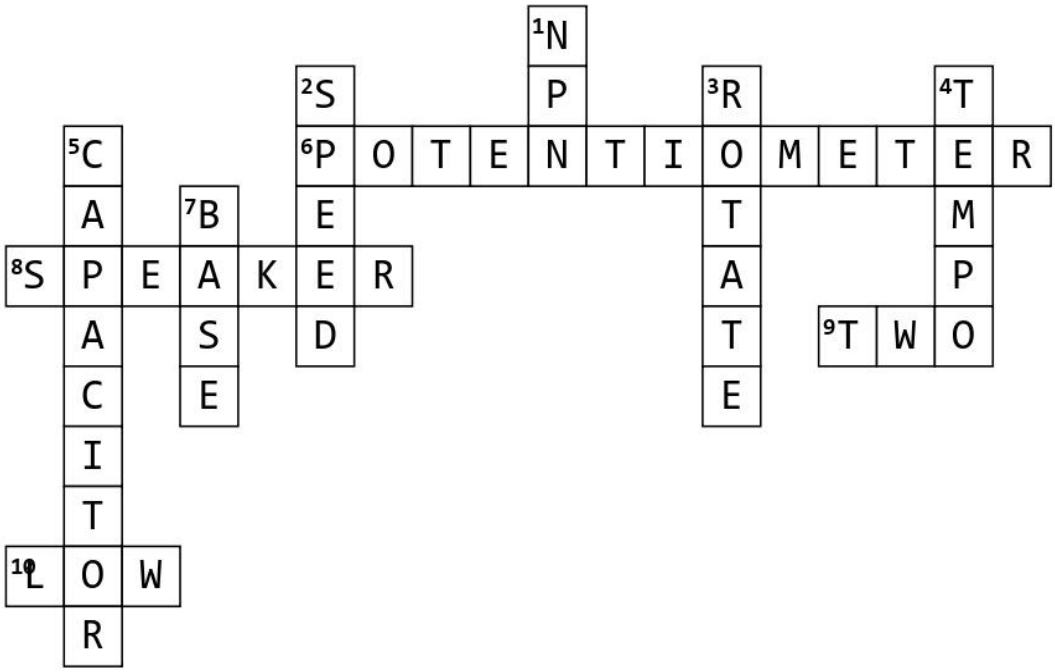
A. Collector
B. Anode
C. Emitter
D. Base

(Form SQ15)

Score

ANSWERS FOR CROSSWORD

Exp. 15 - "ELECTRONIC METRONOME CIRCUIT"



Across

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3. To adjust the Potentiometer, you _____ its shaft.

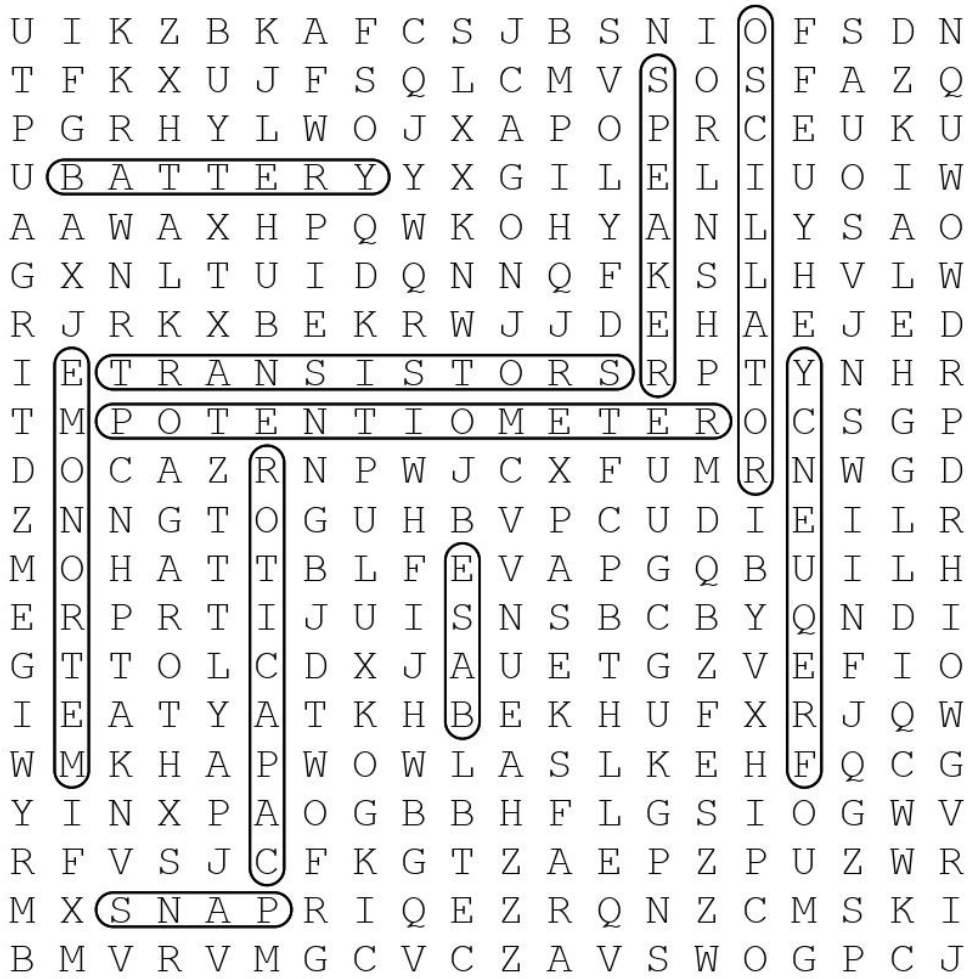
4. What is another word that can be used for the word speed of the oscillator?

5. The value of the _____ in this circuit is 100 microfarads or 100 uF.

7. The Collector pin of Q1 is connected to the _____ of transistor Q2.

ANSWERS FOR WORD SEARCH

Exp. 15 - "ELECTRONIC METRONOME CIRCUIT"



1. A device that makes clicking sounds for setting the music tempo.

2. The electronic component we use to adjust the speed of the oscillation of this circuit.

3. We used two of these in this oscillator circuit.

4. This circuit is a two-transistor _____ .

5. This word is the same as speed or tempo.

6. The _____ makes a clicking sound.

7. The _____ charges and discharges in this circuit.

8. This circuit is powered by a nine volt _____ .

9. This is connected to the the 9-volt battery to give power to the circuit.

10. The Collector of transistor Q1 is connected to the _____ of transistor Q2.

QUICK-CHECK ANSWER KEY for Experiment 15 QUIZ
for Mr Circuit Electronics Training ("Electronic Metronome")

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

#1 This metronome circuit is built using _____ .

A. a 555 Timer IC
B. a two-transistor oscillator
C. an SCR
D. a quad amplifier

A
B
C
D

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B. the capacitance of the transistors
C. the loudness of the speaker
D. speed of the oscillation

A
B
C
D

#3 The Emitter of transistor Q1 is connected to the _____ of transistor Q2.

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

A
B
C
D

#4 The potentiometer varies the _____ on the Base of transistor Q1.

A. voltage
B. capacitance
C. resistance
D. current

A
B
C
D

#5 As you adjust the potentiometer from 0 Ohms to its maximum Ohms, the oscillator will _____ in speed.

A. decrease
B. increase
C. remain the same
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A
B
C
D

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C
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D. a capacitance

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B. help control the speed of the oscillator
C. reduce the resistance of the circuit.
D. reduce the voltage used in the circuit

A
B
C
D

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

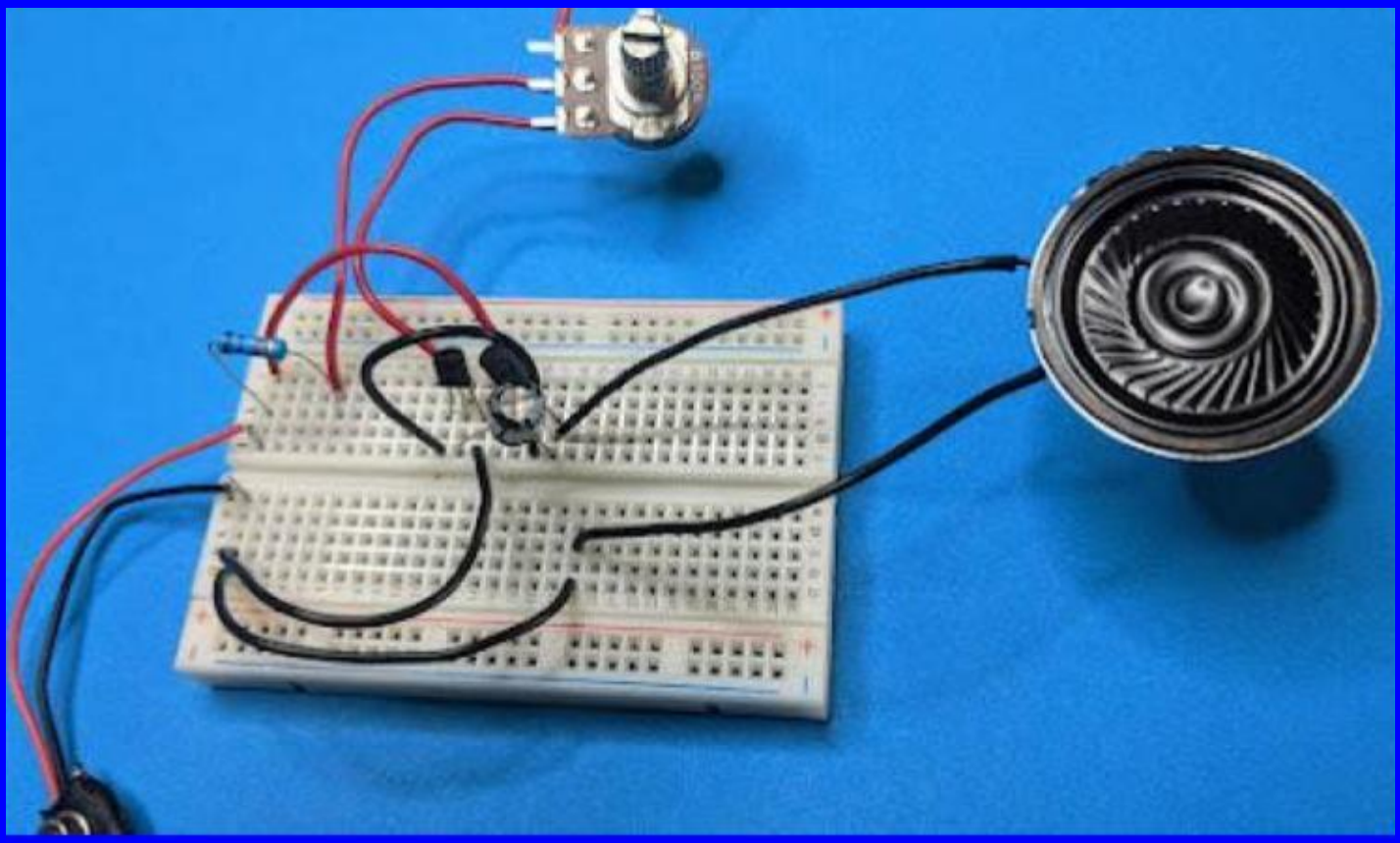
A
B
C
D

#10 The positive lead on Capacitor C1 is connected to the _____ of transistor Q1.

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

BUILD A BETTER FUTURE by UNDERSTANDING SCIENCE-ELECTRONICS

ELECTRONIC METRONOME

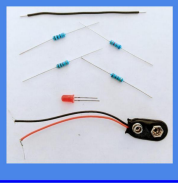


BASIC ELECTRONICS LAB 1

"ELECTRONIC METRONOME"

(Poster MC1-15-P01)

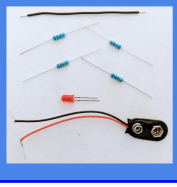
MC1-01
Electronic Parts



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

Mr Circuit Technology

MC1-01
Electronic Parts



PRICE LIST 2024

PRICE LIST

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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 “0 TO 9V DC Power Supply circuit	$2.95
MC1-15-PK	Parts Kit for “Electronic Metronome circuit	$4.95
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MC1-22-PK	Parts Kit for “Solar-Activated Wake-Up Alarm circuit	$3.95
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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
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