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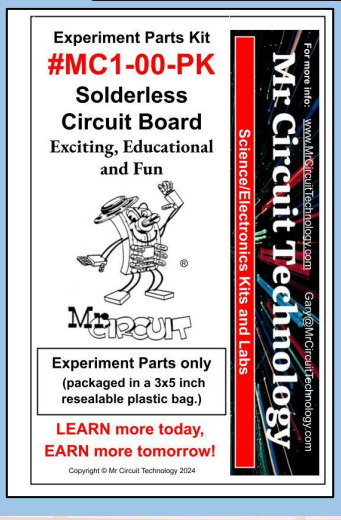
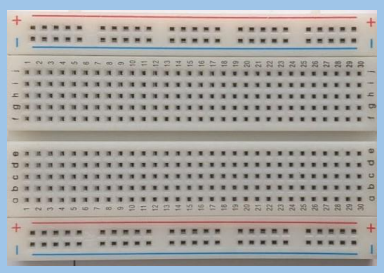
Mr Circuit Technology

Science/Electronics Experiment Kits and Labs

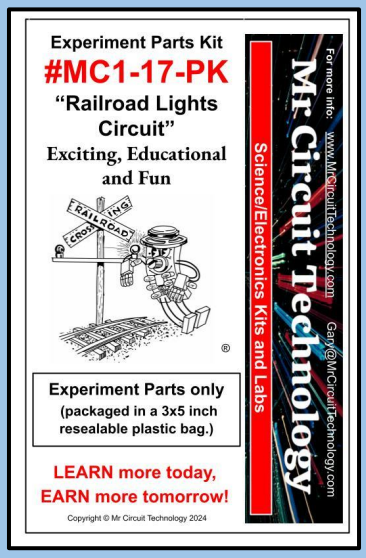
Exp. 17 - "RAILROAD CROSSING LIGHTS CIRCUIT"

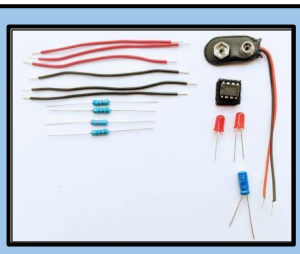




LESSON PLAN

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 #MC1-17-PK (that has the experiment parts) with a 9-Volt battery. Give these items to each student along with the 8 pages.

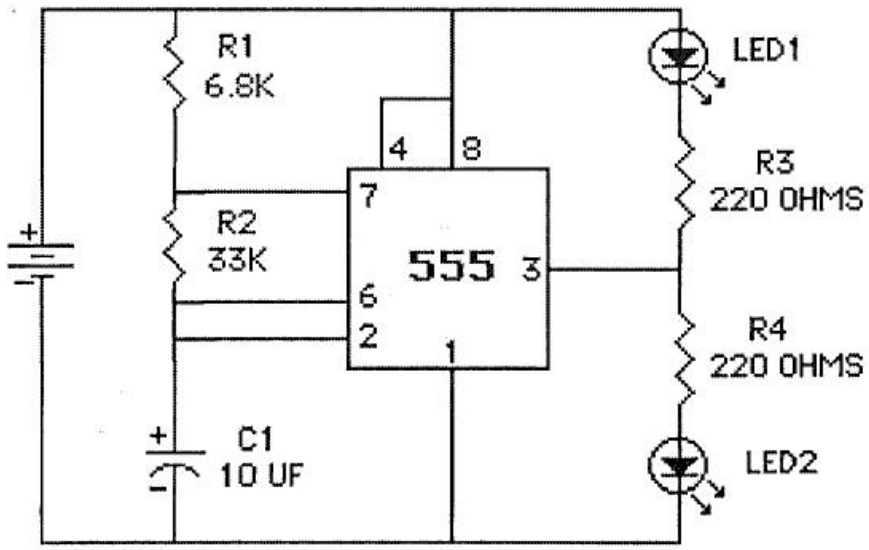
Step 3 - When your students have completed the experiment, collect all the Parts Kits and batteries for later use.

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 RAILROAD CROSSING LIGHTS 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 lights blink like at a railroad crossing.

This circuit has two LEDs that turn on and off alternately.

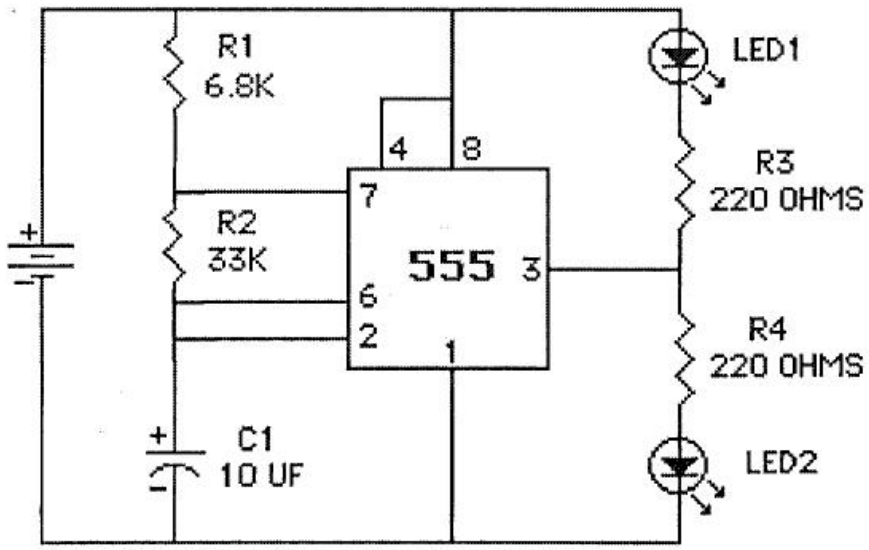
The rate of blinking is about two blinks per second or two Hertz.

You can use this circuit with a model train layout to turn the train crossing signals on and off.

(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 **RAILROAD CROSSING LIGHTS** circuit that you will build.



The 555 IC in this circuit is working as a **CLOCK** which means the 555 is putting out pulses on at a fixed rate per second. The **speed can be adjusted** by changing the values of R1, R2, and C1.

The two LEDs are connected with **opposite polarity** to Pin 3. When Pin 3 is positive, electrons will leave the battery and flow through LED2 to Pin 3. When Pin 3 is negative, electrons will leave Pin 3 and go through LED1 and flow to the positive terminal of the battery.

Note: When the Anode of an LED is connected the Positive and the Cathode is connected to the negative, then the LED is Forward-Biased and the LED will light up. If the LED is Reverse-Biased, it will not light up.

(Continue to Page 3)

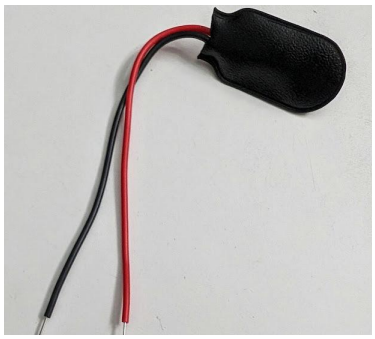
PURPOSE OF THIS EXPERIMENT

*** To build a RAILROAD CROSSING LIGHTS circuit using a 555 Integrated circuit.

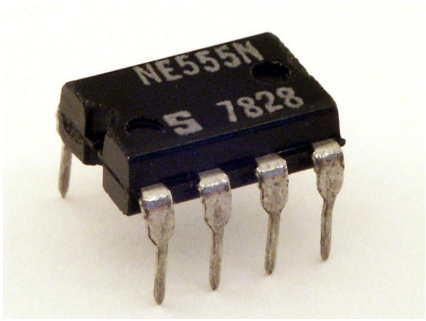
PARTS NEEDED FOR EXPERIMENT

In this experiment, you will use the following items:

9-Volt Snap



555 IC

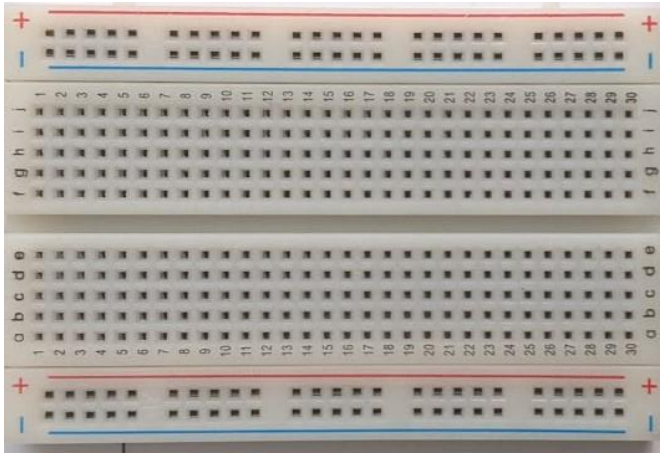


2 LEDs

4 Resistors

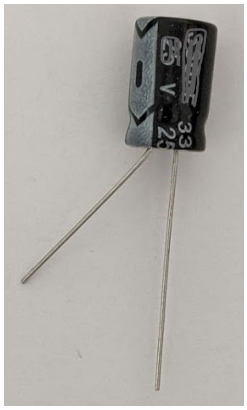
5 Jumper Wires

Solderless Circuit Board



9-V Battery

Radial Capacitor

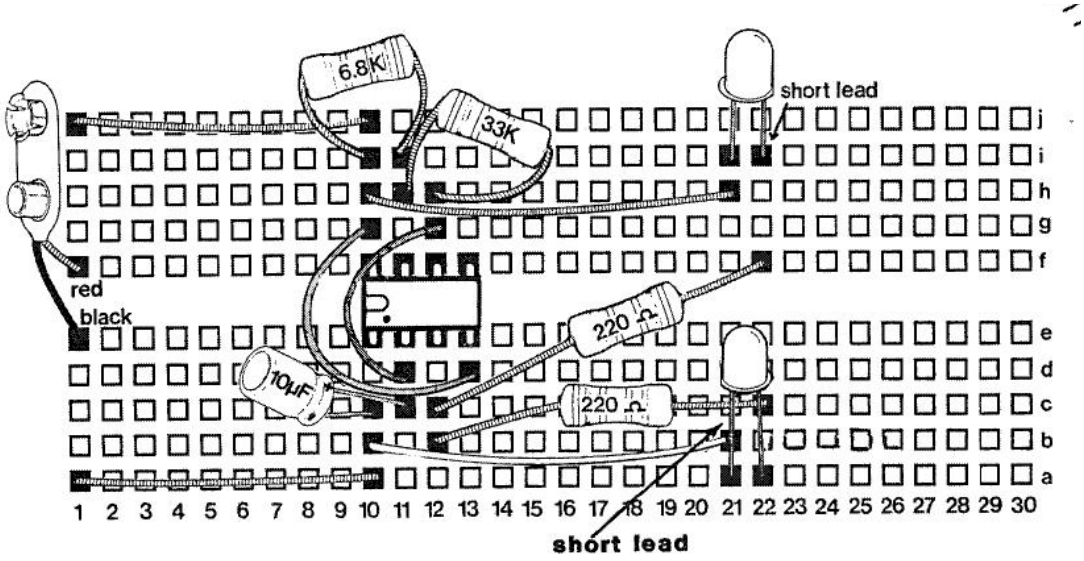


(Continue to Page 4)

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.

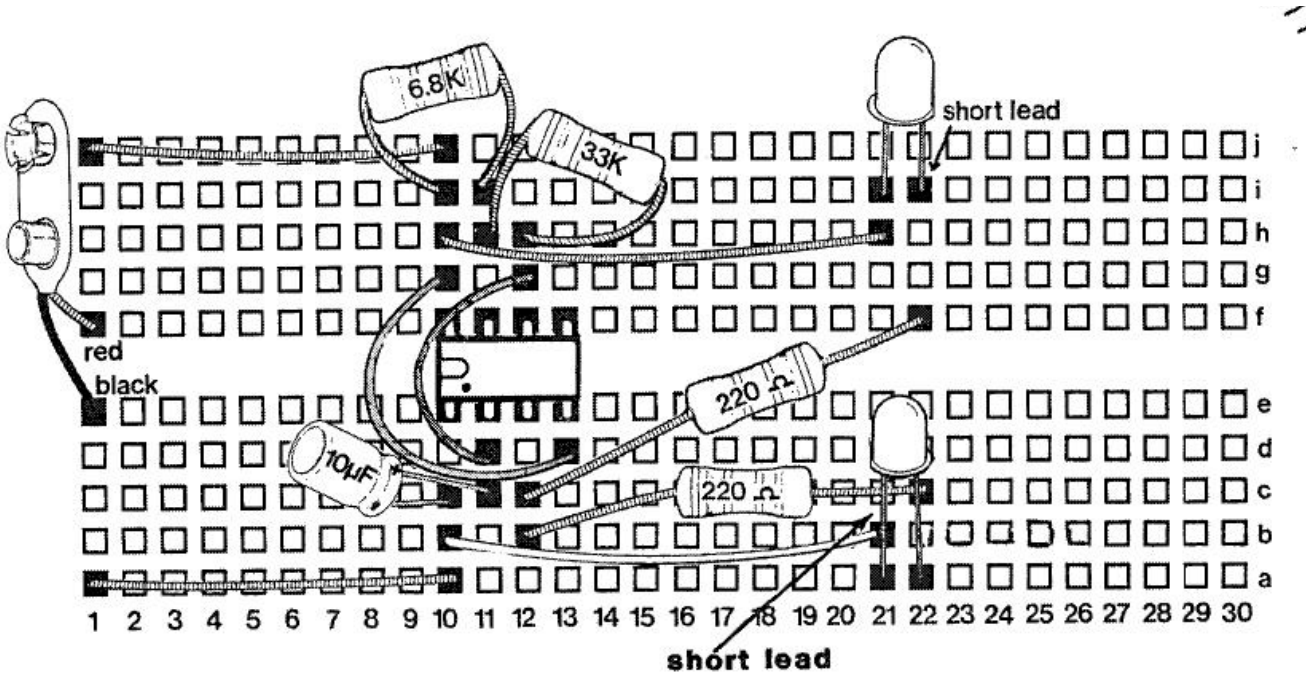


Step 2 - Install all the parts on the SCB as shown above.

- ❑ Install an LED with the Short Lead in hole 22i and the Long Lead in hole 21i
- ❑ Install an LED with the Short Lead in hole 21a and the Long Lead in hole 22a
- ❑ Install the 220 Ohm resistor (red, red, brown, gold) in holes 12c to 22f
- ❑ Install the 220 Ohm resistor (red, red, brown, gold) in holes 12b to 22c
- ❑ Install the 6800 (6.8k) Ohm resistor (blue, gray, red, gold) in holes 10i to 11i
- ❑ Install the 555 Timer IC with Pin 1 in hole 10e as shown in pictorial
- ❑ Install the 10uF Electrolytic Capacitor - Long lead in hole 11c, Short lead in 10c
- ❑ Install Jumper Wire #1 in holes 1a to 10a
- ❑ Install Jumper Wire #2 in holes 1j to 10j
- ❑ Install Jumper Wire #3 in holes 1i to 17h
- ❑ Install Jumper Wire #4 in holes 17g to 20c
- ❑ Install Jumper Wire #5 in holes 18d to 19g
- ❑ Install Jumper Wire #6 in holes 18d to 19g
- ❑ Install the Battery Snap, Black lead in hole 1e 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. The LEDs should blink on and off at a rate of about 2 blinks per second or about 2 Hertz.

CONCLUSION

You should have observed that you can build a
RAILROAD CROSSING LIGHTS circuit
with a
555 Integrated Circuit.

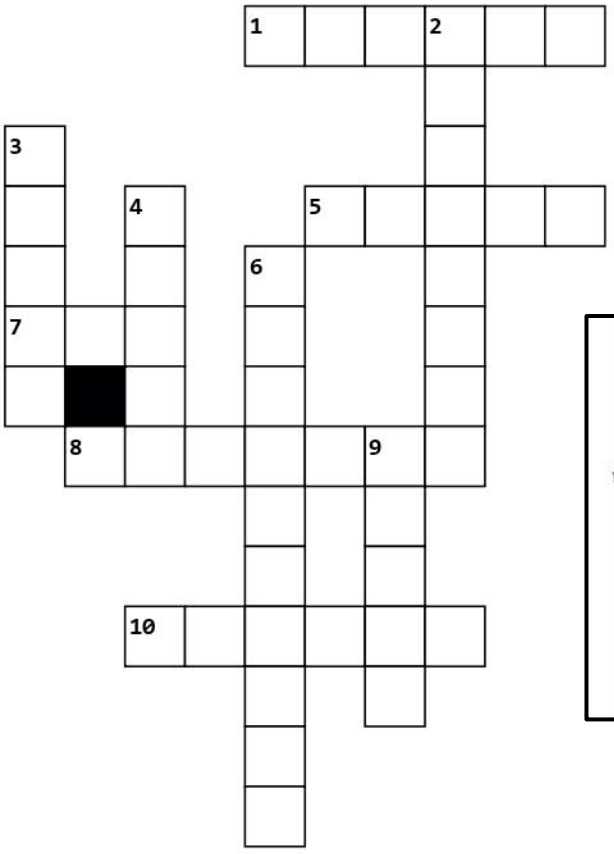
(End of Experiment 11)

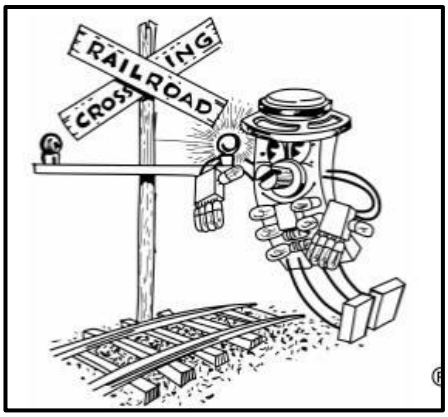
Mr. CIRCUIT®

MC1-17-CW

CROSSWORD

Exp. 17 - "RAILROAD CROSSING LIGHTS CIRCUIT"





Across

1. This circuit blinks the LEDs about two blinks per _____ .

5. The 555 Integrated Circuit is working as a _____ in this circuit.

7. How many LED lights does this circuit use?

8. If an LED is _____ -Biased it will not light up.

10. One of the LEDs is connected in a Forward-_____ way.

Down

2. This circuit uses LEDs that are connected in _____ polarity.

3. Two blinks per second is the same as two _____ .

4. An LED is Forward-Biased when the _____ is connected to positive.

6. This circuit uses a 555 _____ CIRCUIT.

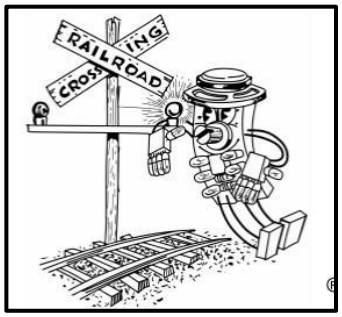
9. The blinking _____ of the LEDs can be adjusted by changing the values of R1, R2, and C1.

Mr. CIRCUIT®

MC1-17-WS

WORD SEARCH

Exp. 17 - "RAILROAD CROSSING LIGHTS CIRCUIT"



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

1. This circuit has two lights called _____ .

2. This circuit uses a 555 _____ circuit.

3. LED #2 in this circuit is _____ -BIASED.

4. LED #1 in this circuit is FORWARD-_____ .

5. The blink rate of the LEDs can be _____ by changing the values of R1, R2, and C1.

6. Two cycles or blinks per second is the same as two _____ .

7. The 555 Integrated circuit is working as a _____ in this circuit.

8. When Pin 3 on the 555 is _____, LED #2 will light up.

9. When Pin 3 on the 555 is _____ , LED #1 will light up.

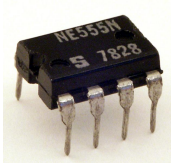
10. An LED has two leads. One is called the CATHODE (negative) and the other is called the _____ (positive).

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

QUIZ for Exp 17 or STEM KIT #17
in the Mr Circuit Electronics Training Lab 1

(Page 8)

This Quiz covers the training learned by completing



"Build a Railroad Lights Circuit" Experiment 17

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 uses _____ working as a clock?

A. an NPN Transistor
B. a 555 Timer IC
C. a PNP Transistor
D. a Potentiometer

A B C D

#2 When pin 3 on the 555 Timer is positive, _____ will be forward biased.

A. LED 1
B. Resistor R1
C. Resistor R3
D. LED 2

A B C D

#3 The two LEDs in this circuit are installed in _____ polarity.

A. the same
B. amplifying
C. opposite
D. dual

A B C D

#4 What is the value of the capacitor connected to Pin 2 of the 555 Timer IC in this circuit?

A. 1000uF
B. 10uF
C. 33uF
D. 470uF

A B C D

#5 If we reverse the polarity of the battery snap on the circuit, what will happen?

A. it will work just fine
B. you might destroy the 555 Timer IC
C. the LED will burn out
D. the LED will self-destruct

A B C D

#6 The speed if the blinking LEDs is _____ .

A. variable
B. super fast
C. fixed
D. super slow

A B C D

#7 When this circuit is working, the LEDs will _____ .

A. blink on and off alternately
B. remain off permanently
C. remain on
D. get hot and self-destruct

A B C D

#8 When an LED is _____ it means that the Anode is positive and the Cathode is negative.

A. reverse-biased
B. forward-biased
C. will not turn on
D. will change from Red to Green

A B C D

#9 When an LED is _____ it means that the Anode is negative and the Cathode is positive.

A. reverse-biased
B. forward-biased
C. will not turn on
D. will change from Red to Green

A B C D

#10 When an LED is forward biased, it will _____ .

A. self-destruct
B. turn on
C. get hot
D. turn off

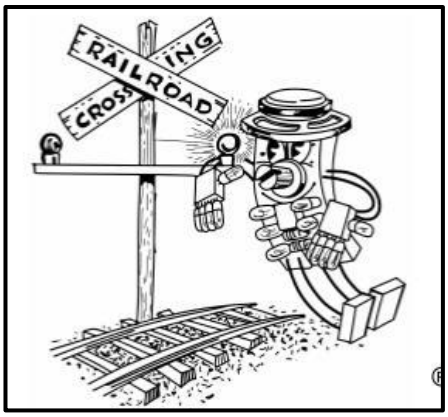
(Form SQ17)

Score	

ANSWERS FOR CROSSWORD

Exp. 17 - "RAILROAD CROSSING LIGHTS CIRCUIT"

				[1]S	E	C	[2]O	N	D
							P		
[3]H							P		
E		[4]A			[5]C	L	O	C	K
R		N		[6]I			S		
[7]T	W	O		N			I		
Z	■	D		T			T		
	[8]R	E	V	E	R	[9]S	E		
				G		P			
				R		E			
		[10]B	I	A	S	E	D		
				T		D			
				E					
				D					



Across

1. This circuit blinks the LEDs about two blinks per _____ .

5. The 555 Integrated Circuit is working as a _____ in this circuit.

7. How many LED lights does this circuit use?

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10. One of the LEDs is connected in a Forward-_____ way.

Down

2. This circuit uses LEDs that are connected in _____ polarity.

3. Two blinks per second is the same as two _____ .

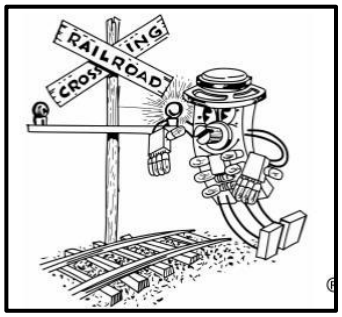
4. An LED is Forward-Biased when the _____ is connected to positive.

6. This circuit uses a 555 _____ CIRCUIT.

9. The blinking _____ of the LEDs can be adjusted by changing the values of R1, R2, and C1.

ANSWERS FOR WORD SEARCH

Exp. 17 - "RAILROAD CROSSING LIGHTS CIRCUIT"



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

1. This circuit has two lights called _____ .

2. This circuit uses a 555 _____ circuit.

3. LED #2 in this circuit is _____ -BIASED.

4. LED #1 in this circuit is FORWARD-_____ .

5. The blink rate of the LEDs can be _____ by changing the values of R1, R2, and C1.

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7. The 555 Integrated circuit is working as a _____ in this circuit.

8. When Pin 3 on the 555 is _____, LED #2 will light up.

9. When Pin 3 on the 555 is _____ , LED #1 will light up.

10. An LED has two leads. One is called the CATHODE (negative) and the other is called the _____ (positive).

QUICK-CHECK ANSWER KEY for Experiment 17 QUIZ
for Mr Circuit Electronics Training ("Railroad Lights")

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 circuit uses _____ working as a clock?

A. an NPN Transistor
B. a 555 Timer IC
C. a PNP Transistor
D. a Potentiometer

A B C (D)

#2 When pin 3 on the 555 Timer is positive, _____ will be forward biased.

A. LED 1
B. Resistor R1
C. Resistor R3
D. LED 2

A B (C) D

#3 The two LEDs in this circuit are installed in _____ polarity.

A. the same
B. amplifying
C. opposite
D. dual

A (B) C D

#4 What is the value of the capacitor connected to Pin 2 of the 555 Timer IC in this circuit?

A. 1000uF
B. 10uF
C. 33uF
D. 470uF

A (B) C D

#5 If we reverse the polarity of the battery snap on the circuit, what will happen?

A. it will work just fine
B. you might destroy the 555 Timer IC
C. the LED will burn out
D. the LED will self-destruct

A B (C) D

#6 The speed if the blinking LEDs is _____ .

A. variable
B. super fast
C. fixed
D. super slow

(A) B C D

#7 When this circuit is working, the LEDs will _____ ?

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B. remain off permanently
C. remain on
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A (B) C D

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A. reverse-biased
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C. will not turn on
D. will change from Red to Green

(A) B C D

#9 When an LED is _____ it means that the Anode is negative and the Cathode is positive.

A. reverse-biased
B. forward-biased
C. will not turn on
D. will change from Red to Green

A (B) C D

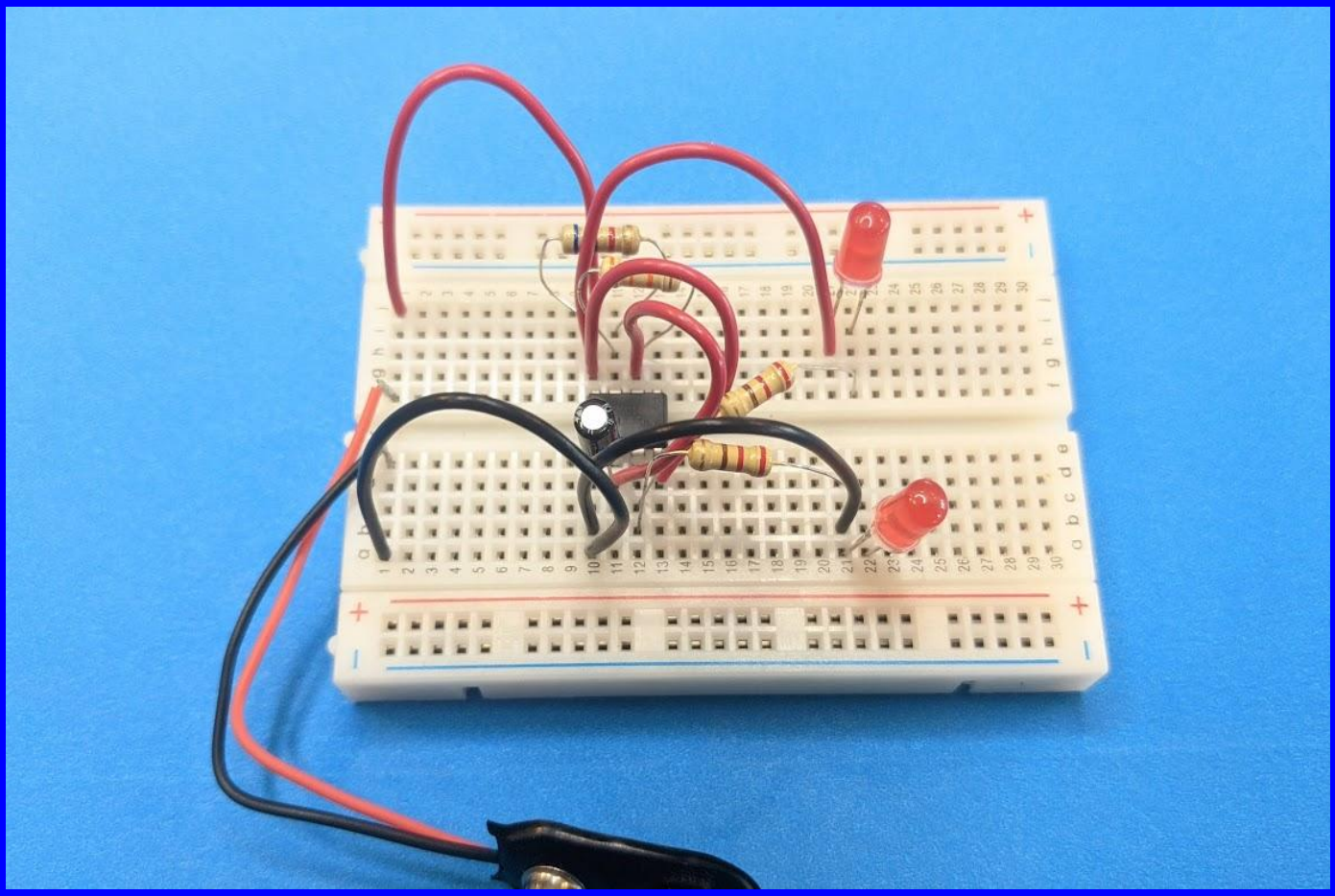
#10 When an LED is forward biased, it will _____ .

A. self-destruct
B. turn on
C. get hot
D. turn off

(Form SQAK17)

BUILD A BETTER FUTURE by UNDERSTANDING SCIENCE-ELECTRONICS

RAILROAD LIGHTS



BASIC ELECTRONICS LAB 1

"RAILROAD LIGHTS CIRCUIT"

(Poster MC1-17-P01)

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

Mr Circuit Technology

PRICE LIST

PRICE LIST

PARTS KIT Number	Mr Circuit Series 1 PARTS KITS FOR "LESSON PLANS"	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
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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
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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
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
MC1-SET-PK	**Complete Set of All Series 1 Parts Kits (31 total)**	**$120.00**