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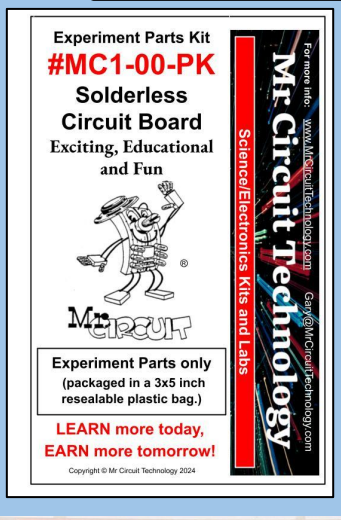
Mr Circuit Technology

Science/Electronics Experiment Kits and Labs

Exp. 13 - "SOLAR-ACTIVATED NIGHT LIGHT CIRCUIT"



LESSON PLAN

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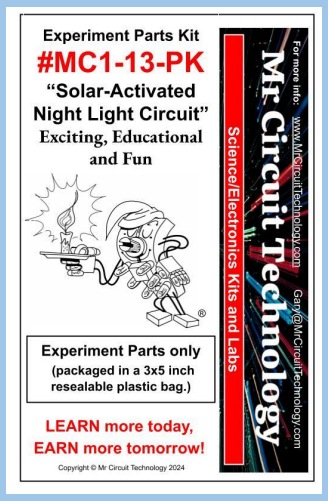
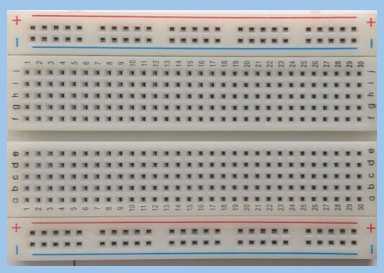




PREPARATION: You can put the Page 12 poster up on your classroom wall to announce the fact that you are going to do the Science-Electronics Experiment.

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 #MC1-13-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.

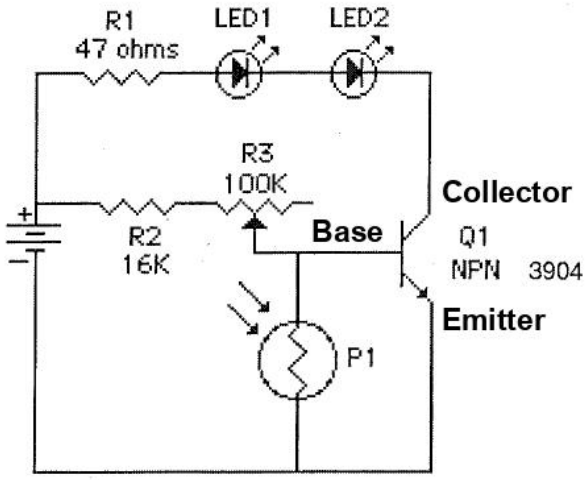
For Tech Support or any questions, you can email us or call 805-295-1642

EXPLANATION OF EXPERIMENT part 1 of 2

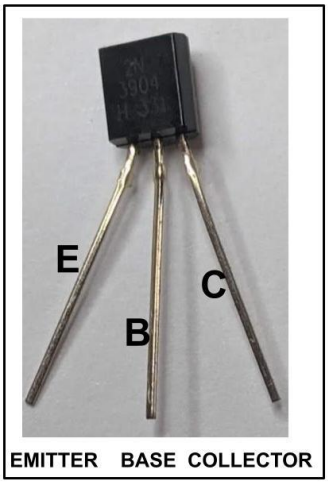
*** You are going to build a Solar-Activated Night Light circuit that will turn off the LED lights when it gets light outside. Here is the SCHEMATIC DIAGRAM of the circuit you will build.

PHOTOCELL

SCHEMATIC DIAGRAM



TRANSISTOR



This interesting circuit was invented by engineers who needed a circuit that would turn off lights during the day and turn on lights at night.

This circuit uses the special property of a Photocell. A Photocell will reduce its resistance when light hits it.

As the Photocell has its resistance reduced, the Transistor will conduct less and less current which will, in turn, make the LEDs to get less and less bright.

So, the more light that hits the Photocell, the less bright the LEDs in the circuit. When the circuit is placed in a dark place, the LEDs will light up.

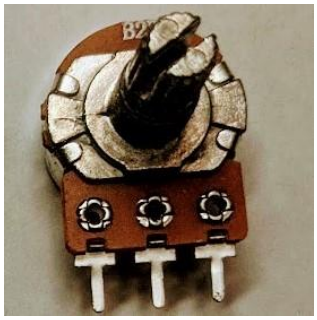
(Continue to Page 2)

EXPLANATION OF EXPERIMENT part 2 of 2

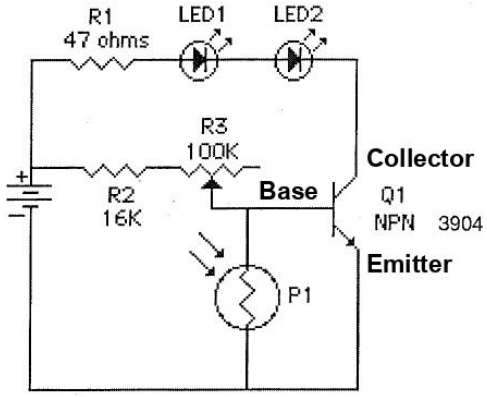
Let's talk about how the circuit works. Here is the schematic of the SOLAR-ACTIVATED NIGHT LIGHT circuit that you will build. **(It is sometimes called an Automatic Night Light.)**

PHOTOCELL

POTENTIOMETER



SCHEMATIC DIAGRAM



In this circuit, the more current that is flowing through the transistor, the more current that is flowing through the two LEDs. The purpose of the 47 Ohm resistor is to limit the amount of current flowing through the LEDs.

To make more current flow through the transistor, we have to **INCREASE** the resistance of the Photocell. To increase the resistance of the Photocell, we have to KEEP light from hitting it.

So, when this circuit is in a dark room, the LEDs will light up. When lights are turned on in the room, the LEDs will not light up.

The Potentiometer is a sensitivity control. You can adjust it to set the level of darkness that will make the LEDs light up.

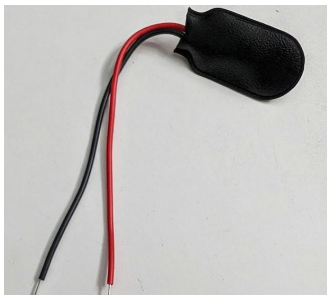
(Continue to Page 3)

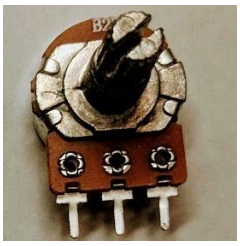
PURPOSE OF THIS EXPERIMENT

*** To BUILD A SOLAR-ACTIVATED NIGHT LIGHT CIRCUIT USING A PHOTOCELL.

PARTS NEEDED FOR EXPERIMENT

In this experiment, you will use

a BATTERY SNAP 

a POTENTIOMETER 

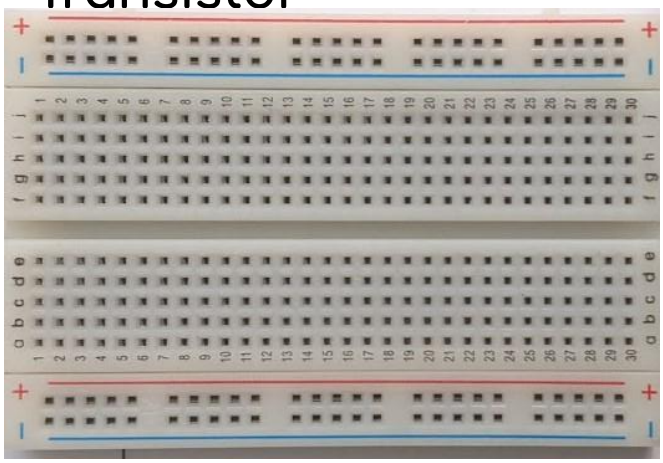
two LEDs 

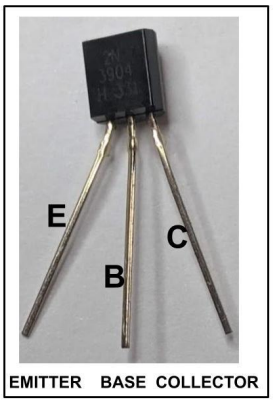
PHOTOCELL 

47 Ohm resistor 

16k Ohm resistor 

3 Jumper Wires 

a SOLDERLESS CIRCUIT BOARD 

an NPN Transistor 

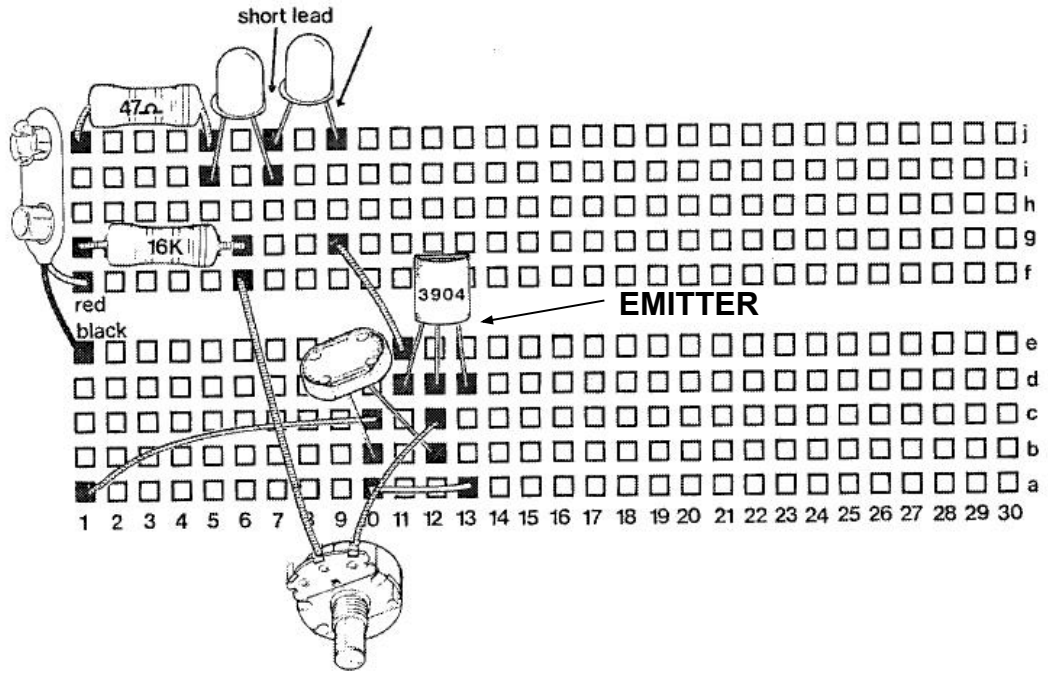
You will also need a good 9 Volt battery

(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.

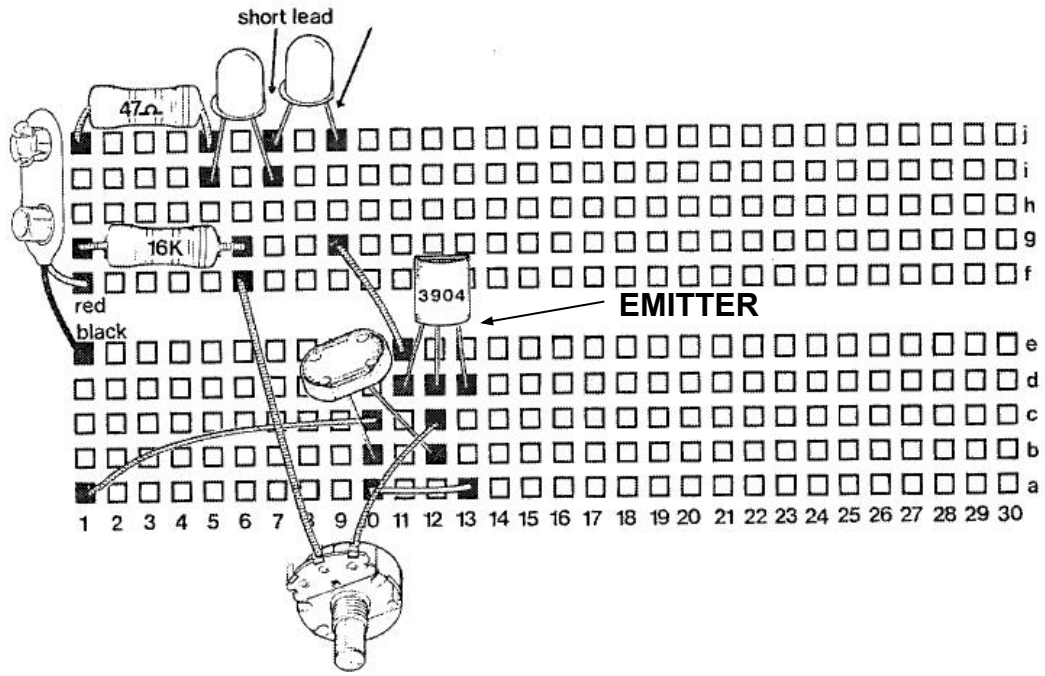


Step 2 - Install all the parts on the SCB as shown above.

- ❑ Install an LED with the Short Lead in hole 9j and the Long Lead in hole 7j
- ❑ Install an LED with the Short Lead in hole 7i and the Long Lead in hole 5i
- ❑ Install the 47 Ohm resistor (yellow, violet, black, gold) in holes 1j to 5j
- ❑ Install the 16k Ohm resistor (brown, blue, orange, gold) in holes 1g to 6g
- ❑ Install the Photocell in holes 10b to 12b
- ❑ Install the NPN 3904 Transistor - Emitter in 13d, Base in 12d, Collector in 11d
- ❑ Install the Potentiometer, edge lead in hole 12c, middle lead in hole 6f
- ❑ Install Jumper Wire #1 in holes 1a to 10c
- ❑ Install Jumper Wire #2 in holes 9g to 11e
- ❑ Install Jumper Wire #3 in holes 10a to 13a
- ❑ 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. Adjust the Potentiometer back and forth until you see the LEDs go out. Then put the circuit in a dark place and the LEDs should turn on.

Once you have adjusted the sensitivity to the right place, you are ready to use the circuit.

CONCLUSION

You should have observed that you can build a circuit with a Photocell that will turn on LEDs when it gets dark.

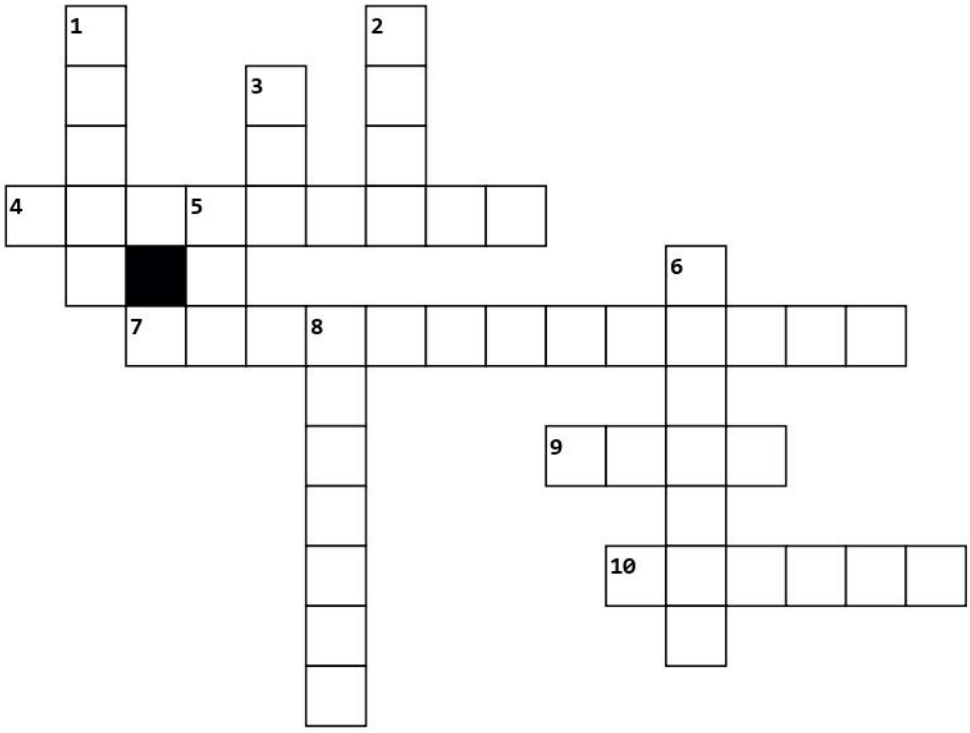
You can experiment with it in different light situations. You can put the circuit in a drawer and close the drawer. The LEDs will turn on when you close the drawer and turn off when you open it,. (Kind of hard to see in a closed drawer. LOL)

(End of Experiment 11)

MC1-13-CW

CROSSWORD

Experiment 13 - "Solar-Activated Night Light"



Across

4. What electronic component varies its resistance with light?

7. What component do we use to adjust the sensitivity?

9. The color bands on the 16k Ohm resistor are Brown, _____ , Orange, and Gold.

10. The purpose of the 47 Ohm resistor in the circuit is to _____ the current through the LEDS.

Down

1. The two LEDs in this circuit will turn on when it is _____ .

2. How many volts are use to power this circuit?

3. How many LEDs do we use in this circuit?

5. In this circuit, how many leads do we use of the three leads on the Potentiometer?

6. When light hits a photocell, its resistance _____ .

8. The_____ pin of the transistor is in hole 13d of the Solderless Circuit Board.

Mr. CIRCUIT®

MC1-13-WS

WORD SEARCH

Experiment 13 - "Solar-Activated Night Light"

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

1. The transistor in the circuit has three pins; the _____, BASE, AND COLLECTOR.

2. The component in the circuit that varies its resistance with light.

3. The component that lights up when current flows through it.

4. The component used to adjust the sensitivity of the circuit.

5. The amount of volts used to power this circuit.

6. This circuit is called a SOLAR-ACTIVATED _____ LIGHT.

7. This circuit can also be called an _____ NIGHT LIGHT circuit.

8. The 47 Ohm resistor _____ the current flowing through the two LEDs.

9. The transistor used in this circuit is an _____ Bipolar Transistor.

10. This circuit will turn on the LEDs when it gets _____ .

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

QUIZ for Exp 13 or STEM KIT #13 in the Mr Circuit Electronics Training Lab 1

This Quiz covers the training learned by completing

"Build an Solar-Activated Night Light Circuit" Experiment 13

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

A B C D

#1 This Automatic Night Light will turn on automatically _____?

A. when there is light.
B. when there is darkness.
C. at noon each day.
D. when it is humid outside.

A B C D

#2 How many LEDs are there in this circuit?

A. 1
B. 3
C. 2
D. 5

A B C D

#3 What is the purpose of the 47 Ohm resistor in the circuit?

A. to increase the current in the circuit
B. to serve as a fuse for the circuit
C. to increase the brightness of the LEDs
D. limit the current through the LEDs

A B C D

#4 What is the purpose of the Potentiometer in the circuit?

A. to make the LEDs blink
B. to adjust the sensitivity of the Photocell
C. to adjust the loudness
D. to make the battery last longer

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. The LEDs will not light up.
C. The LEDs will burn out.
D. The LEDs will self-destruct.

A B C D

#6 The LEDs receive their current from which pin on the NPN transistor?

A. the Collector
B. the Emitter
C. the Base
D. the Gate

A B C D

#7 Resistor R2, 16k Ohms, is connected directly to which terminal on the 9-Volt battery?

A. the negative
B. the center
C. the neutral
D. the positive

A B C D

#8 The potentiometer has 3 connections. How many do we use in this circuit? .

A. 0
B. 2
C. 3
D. 1

A B C D

#9 What are the colors on Resistor R1, 47 Ohms?

A. yellow, violet, black, gold
B. brown, red, black, gold
C. green, green, brown, gold
D. gray, blue, brown, gold

A B C D

#10 This circuit is used to turn on the LEDs _____.

A. when the weather is hot
B. during the day
C. at night
D. when it is a humid day

(Form SQ13)

Score

ANSWERS FOR CROSSWORD

Experiment 13 - "Solar-Activated Night Light"

	[1]N					[2]N								
	I			[3]T		I								
	G			W		N								
[4]P	H	O	[5]T	O	C	E	L	L						
	T		W							[6]R				
		[7]P	O	T	[8]E	N	T	I	O	M	E	T	E	R
					M						D			
					I				[9]B	L	U	E		
					T						C			
					T					[10]R	E	D	U	C	E
					E						S			
					R									

Across

4. What electronic component varies its resistance with light?

7. What component do we use to adjust the sensitivity?

9. The color bands on the 16k Ohm resistor are Brown, _____ , Orange, and Gold.

10. The purpose of the 47 Ohm resistor in the circuit is to _____ the current through the LEDS.

Down

1. The two LEDs in this circuit will turn on when it is _____ .

2. How many volts are use to power this circuit?

3. How many LEDs do we use in this circuit?

5. In this circuit, how many leads do we use of the three leads on the Potentiometer?

6. When light hits a photocell, its resistance _____ .

8. The_____ pin of the transistor is in hole 13d of the Solderless Circuit Board.

ANSWERS FOR WORD SEARCH

Experiment 13 - "Solar-Activated Night Light"

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

1. The transistor in the circuit has three pins; the _____, BASE, AND COLLECTOR.

2. The component in the circuit that varies its resistance with light.

3. The component that lights up when current flows through it.

4. The component used to adjust the sensitivity of the circuit.

5. The amount of volts used to power this circuit.

6. This circuit is called a SOLAR-ACTIVATED _____ LIGHT.

7. This circuit can also be called an _____ NIGHT LIGHT circuit.

8. The 47 Ohm resistor _____ the current flowing through the two LEDs.

9. The transistor used in this circuit is an _____ Bipolar Transistor.

10. This circuit will turn on the LEDs when it gets _____ .

QUICK-CHECK ANSWER KEY for Experiment 13 QUIZ
for Mr Circuit Electronics Training ("Solar-Activiated Night Light")

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 Automatic Night Light will turn on automatically _____?

A. when there is light.
B. when there is darkness.
C. at noon each day.
D. when it is humid outside.

A
B
(C)
D

#2 How many LEDs are there in this circuit?

A. 1
B. 3
C. 2
D. 5

A
B
C
(D)

#3 What is the purpose of the 47 Ohm resistor in the circuit?

A. to increase the current in the circuit
B. to serve as a fuse for the circuit
C. to increase the brightness of the LEDs
D. limit the current through the LEDs

A
(B)
C
D

#4 What is the purpose of the Potentiometer in the circuit?

A. to make the LEDs blink
B. to adjust the sensitivity of the Photocell
C. to adjust the loudness
D. to make the battery last longer

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. The LEDs will not light up.
C. The LEDs will burn out.
D. The LEDs will self-destruct.

#6 The LEDs receive their current from which pin on the NPN transistor?

A. the Collector
B. the Emitter
C. the Base
D. the Gate

(A)
B
C
D

#7 Resistor R2, 16k Ohms, is connected directly to which terminal on the 9-Volt battery?

A. the negative
B. the center
C. the neutral
D. the positive

A
B
C
(D)

#8 The potentiometer has 3 connections. How many do we use in this circuit? .

A. 0
B. 2
C. 3
D. 1

A
(B)
C
D

#9 What are the colors on Resistor R1, 47 Ohms?

A. yellow, violet, black, gold
B. brown, red, black, gold
C. green, green, brown, gold
D. gray, blue, brown, gold

(A)
B
C
D

#10 This circuit is used to turn on the LEDs _____.

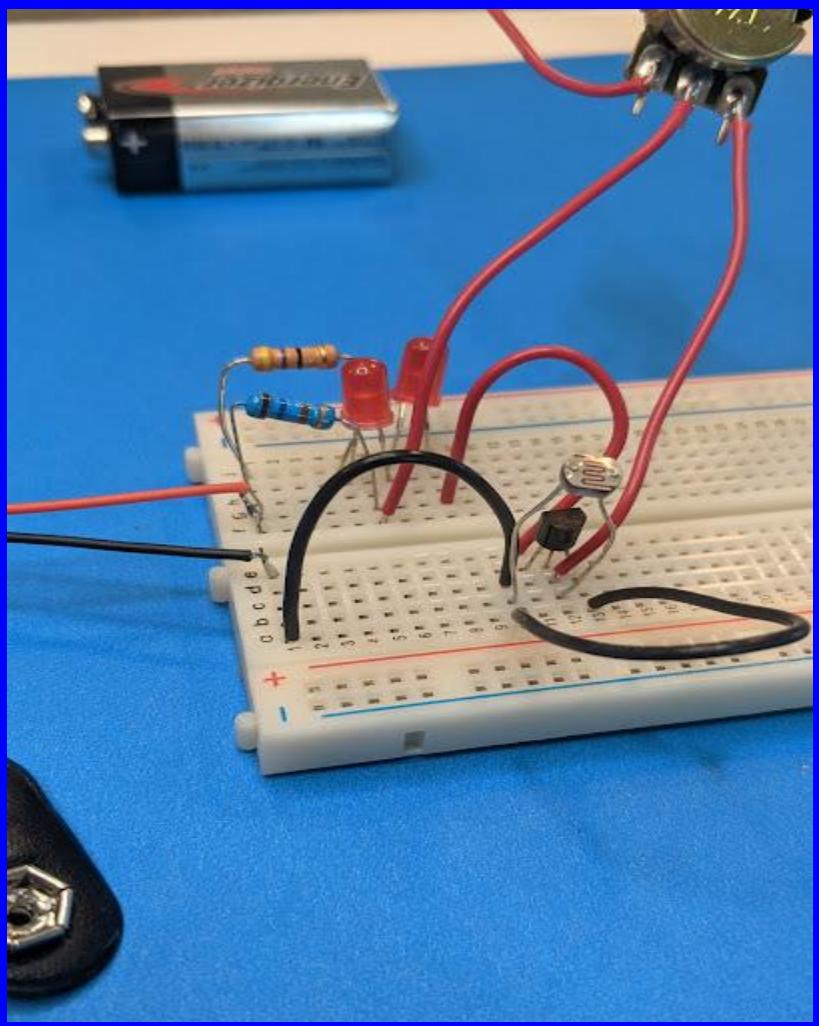
A. when the weather is hot
B. during the day
C. at night
D. when it is a humid day

A
B
(C)
D

(Form SQAK13)

BUILD A BETTER FUTURE by UNDERSTANDING SCIENCE-ELECTRONICS

SOLAR-ACTIVATED NIGHT LIGHT

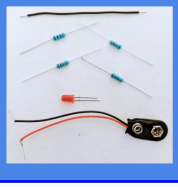


BASIC ELECTRONICS LAB 1

"SOLAR-ACTIVATED NIGHT LIGHT"

(Poster MC1-13-P01)

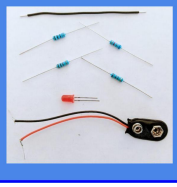
MC1-01
Electronic Parts



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**