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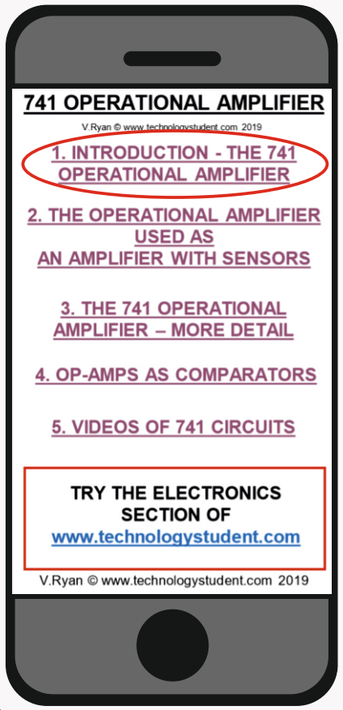
A



THE 741 OPERATIONAL AMPLIFIER

TO ANSWER ALL THE QUESTIONS YOU WILL NEED TO DOWNLOAD THE '741 OPERATIONAL AMPLIFIER AND COMPARATOR' APP, FROM THE INTERACTIVE MOBILE APP SECTION OF www.technologystudent.com

LINK

http://www.technologystudent.com/mobapps/741%20operational%20amplifier1.pdf

Once you have downloaded the App, you can use it to navigate the website. You may need to follow the links on each page of the App, to research / complete answers to all the questions.

ARE YOU READY?
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1 WHAT IS A 741 OPERATIONAL AMPLIFIER?

2 MAKE A LIST OF ELECTRICAL PRODUCTS, THAT YOU THINK HAVE OPERATIONAL AMPLIFIERS, AS A COMPONENT(S) IN THEIR CIRCUITS.

You may need to search the internet.

3 LIST THE NAMES OF THE COMPONENTS, , SEEN IN THE NEXT BOX, IDENTIFIED BY THE ARROWS.

A: _____

B: _____

C: _____

D: _____

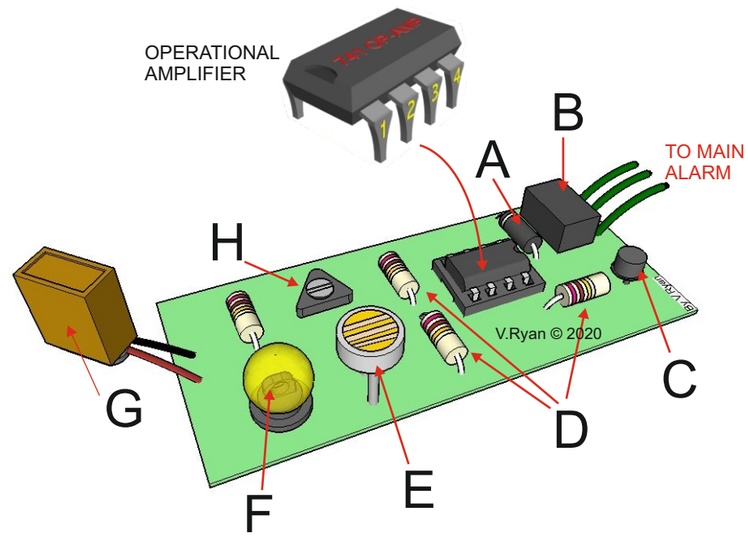
E: _____

F: _____

G: _____

H: _____

4 THE CIRCUIT BELOW IS PART OF A LARGER ALARM CIRCUIT. WHEN IT DETECTS MOVEMENT (IE. AN INTRUDER), IT SENDS A SIGNAL TO THE MAIN ALARM SYSTEM, WHICH SOUNDS THE SIREN. WHAT IS THE FUNCTION OF THE OPERATIONAL AMPLIFIER, IN THIS CIRCUIT?



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THE 741 OPERATIONAL AMPLIFIER - USED FOR SENSORS

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ARE YOU READY?
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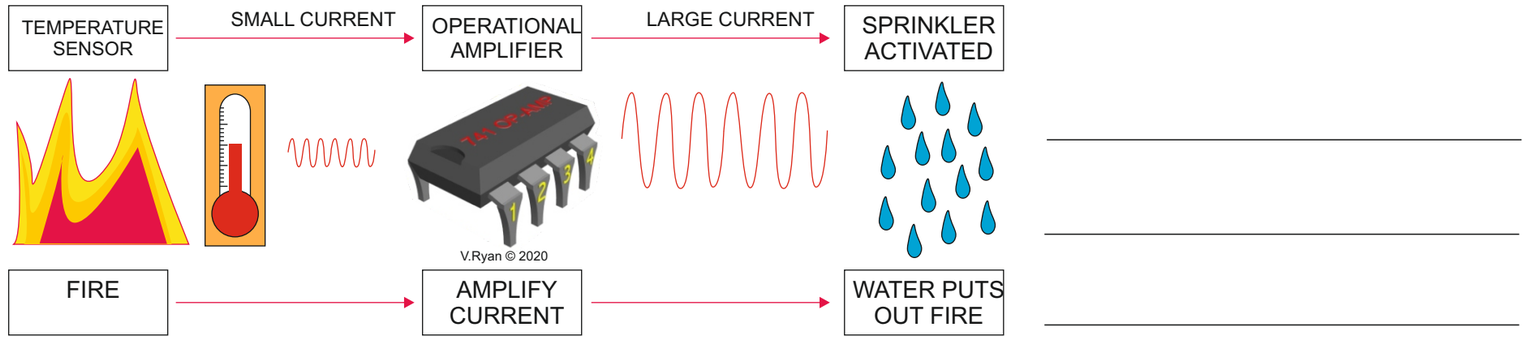
1

THE SYSTEMS DIAGRAM BELOW, SHOWS A TEMPERATURE SENSOR, AN OPERATIONAL AMPLIFIER AND A SPRINKLER SYSTEM. EXPLAIN HOW THE THREE SUBSYSTEMS WORK TOGETHER, AS AN EFFECTIVE FIRE PREVENTION SYSTEM.



2

THE INCOMPLETE SYSTEMS DIAGRAM OPPOSITE, SHOWS HOW A SMALL CURRENT (SOMETIMES CALLED A SIGNAL), IS AMPLIFIED BY AN OPERATIONAL AMPLIFIER, TO PRODUCE A LARGER CURRENT (SIGNAL).

DRAW AN ACCURATE DIAGRAM REPRESENTING THE OPERATIONAL AMPLIFIER, IN THE PROCESS SECTION, OF THE SYSTEMS DIAGRAM.

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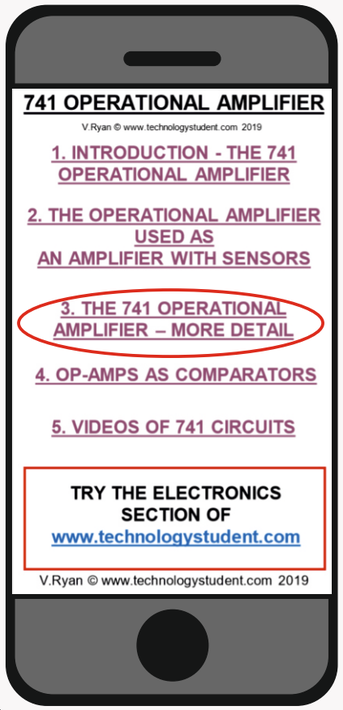
C



THE 741 OPERATIONAL AMPLIFIER - MORE DETAIL

TO ANSWER ALL THE QUESTIONS YOU WILL NEED TO DOWNLOAD THE '741 OPERATIONAL AMPLIFIER AND COMPARATOR' APP, FROM THE INTERACTIVE MOBILE APP SECTION OF www.technologystudent.com

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ARE YOU READY?
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1

COMPLETE THE DESCRIPTIONS OF THE INVERTING AND NON-INVERTING OPERATIONAL AMPLIFIERS.

A. AN INVERTING AMPLIFIER - LEG TWO IS THE INPUT AND THE OUTPUT IS ALWAYS

_____.

B. A NON-INVERTING AMPLIFIER - LEG THREE IS THE INPUT AND THE OUTPUT IS

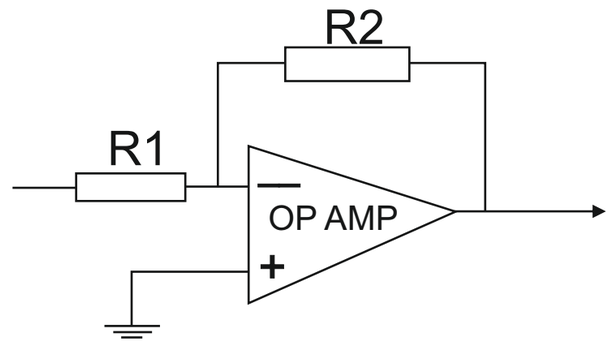
_____.

2

THE INCOMPLETE DIAGRAM BELOW, SHOWS AN INVERTING AMPLIFIER. COMPLETE THE DIAGRAM, BY ADDING THE FOLLOWING:

V_{IN} (voltage in) Inverting - leg two

V out Non-inverting



3

WITH REGARDS TO THE CIRCUIT DIAGRAM SHOWN IN Q2, WHICH OF THE RESISTORS CONTROLS THE AMPLIFICATION?

_____

_____

4

CALCULATE THE 'GAIN', FOR THE FOLLOWING QUESTIONS:

INVERTING AMPLIFIER

GAIN (AV) = -R2 / R1

Question : if R2 is 100 kilo-ohm and R1 is 10 kilo-ohm the gain would be:

_____

_____

_____

_____

NON-INVERTING AMPLIFIER

GAIN (AV) = 1+(R2 / R1)

Question : if R2 is 1000 kilo-ohm and R1 is 100 kilo-ohm the gain would be :

_____

_____

_____

_____

HELPFUL LINK: http://www.technologystudent.com/mobapps/741%20operational%20amplifier1.pdf

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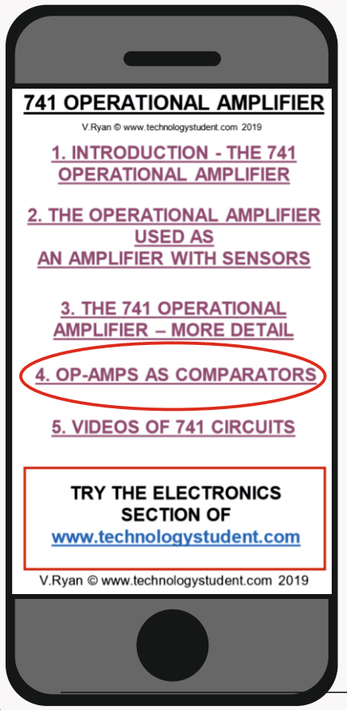
D



OP-AMPS AS COMPARATORS

TO ANSWER ALL THE QUESTIONS YOU WILL NEED TO DOWNLOAD THE '741 OPERATIONAL AMPLIFIER AND COMPARATOR' APP, FROM THE INTERACTIVE MOBILE APP SECTION OF www.technologystudent.com

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ARE YOU READY?
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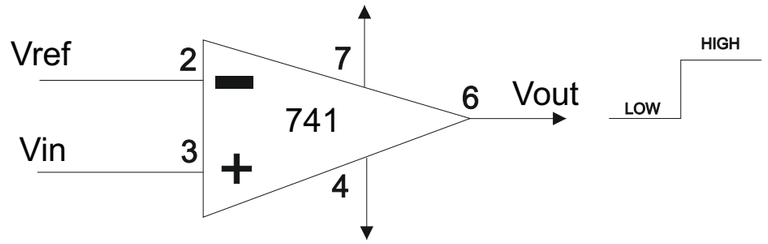
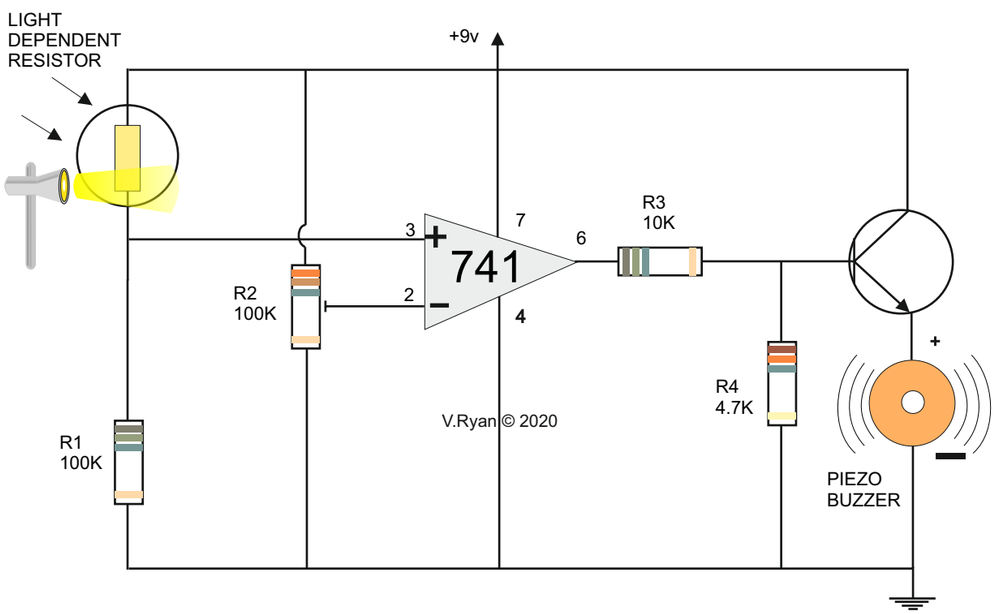
1

THE 741 OP-AMP, CAN BE USED AS A 'COMPARATOR'. DESCRIBE HOW A COMPARATOR WORKS, WITH REFERENCE TO VREF AND VIN, AS SEEN ON THE DIAGRAM OPPOSITE.



2

THE CIRCUIT BELOW, IS A LIGHT ACTIVATED ALERTER. EXPLAIN HOW IT WORKS. INCLUDE AN EXPLANATION OF THE ROLE THE COMPARATOR.



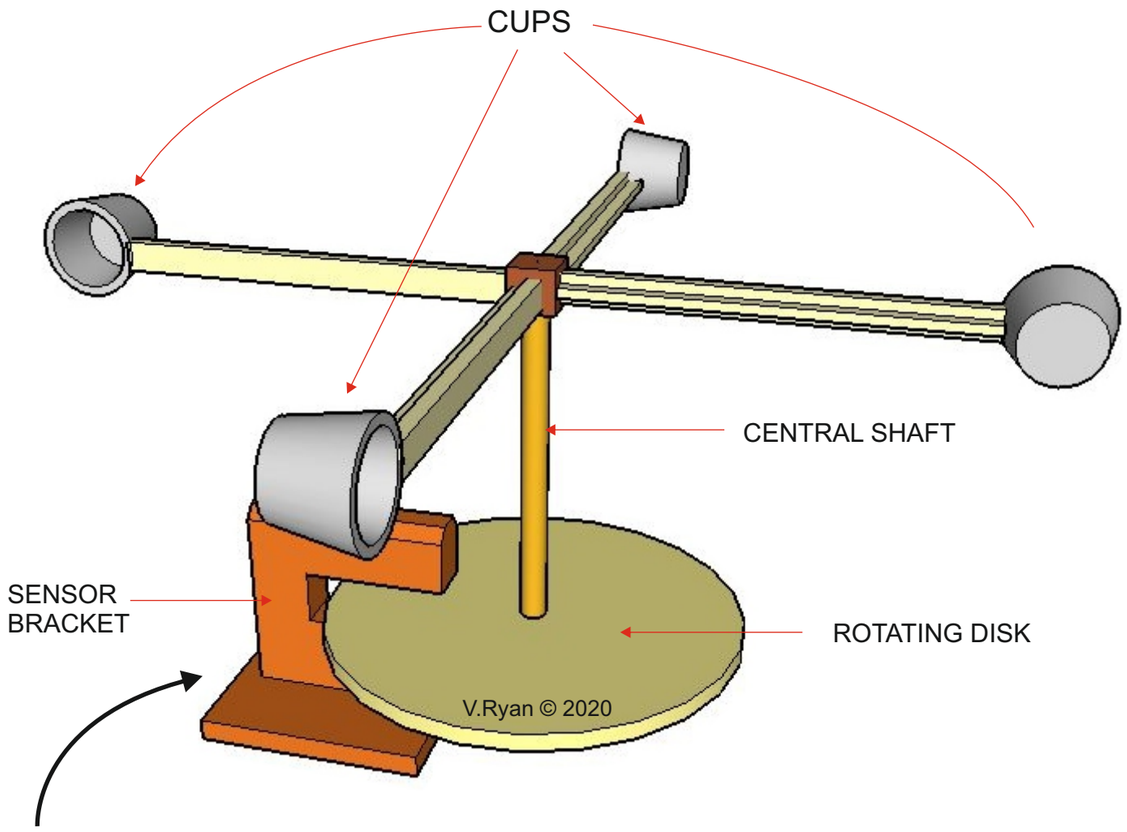
HOW COULD YOU EASILY CONVERT THE LIGHT ACTIVATED CIRCUIT SEEN OPPOSITE TO A DARK ACTIVATED CIRCUIT?

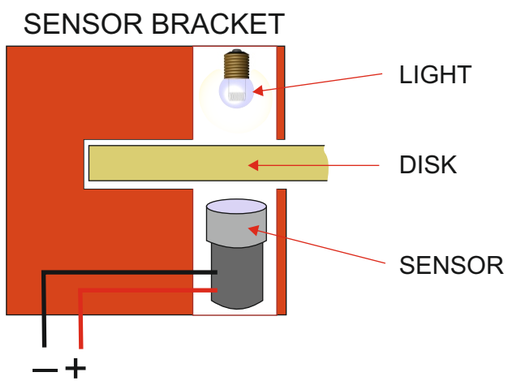
HOW CAN THE CIRCUIT BE CHANGED SO THAT IT BECOMES A TEMPERATURE SENSOR?

E

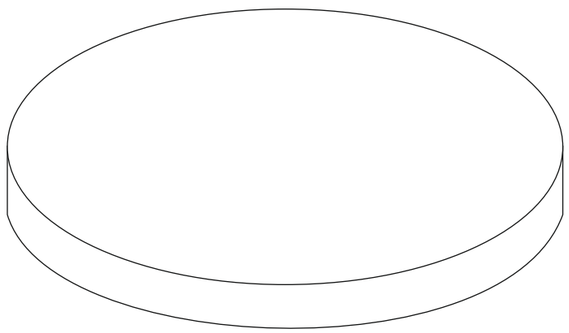
741 OPERATIONAL AMPLIFIER COMPARATOR EXAMINATION QUESTION

A home-made anemometer can be seen below. It is part of a system that calculates the wind speed. It is composed of four cups that rotate on a central shaft. As it rotates a light / dark sensor, housed in the 'sensor bracket' detects light from the light bulb found inside the sensor bracket. The sensor is connected to a circuit that counts each time the disk rotates (light from the bulb is detected).



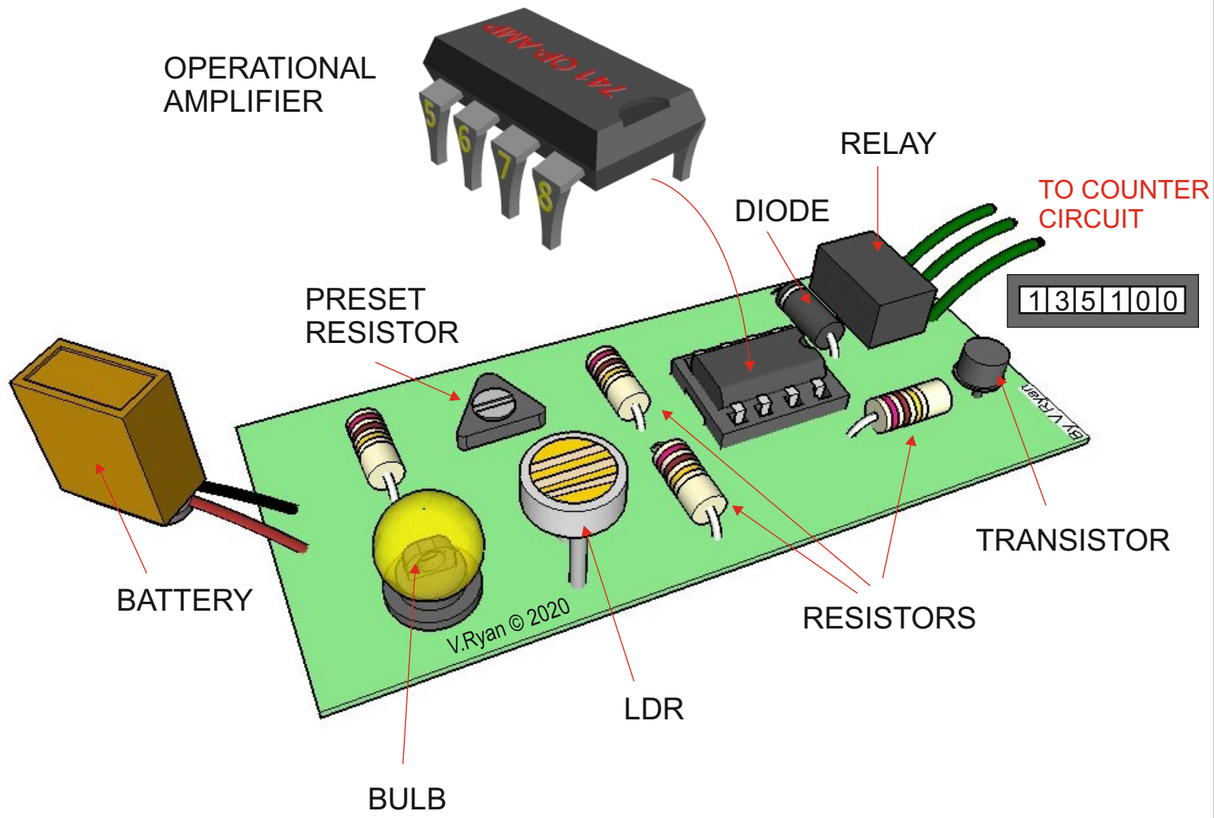


1. The diagram below represents the rotating disk. Draw on the disk any modifications you feel need to be made to allow the sensor to be exposed to the light from the bulb. The sensor must be exposed to the light twice for every rotation. Add notes explaining your answer.



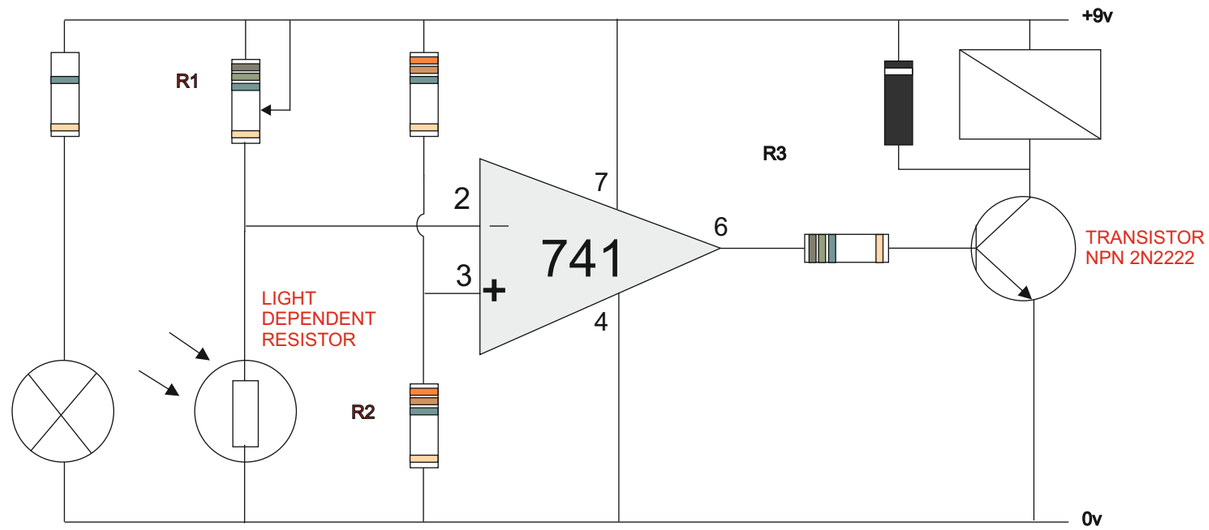
NOTES

2. Below is a 3D version of the sensor / counter circuit.



The circuit diagram of the 3d circuit is seen below. When the light from the bulb shines on the light / dark sensor the resistance of the LDR decreases. This allows current to flow into pin 2. The 741 compares the current of pin 2 and pin 3. When a change in current occurs in either pin 2 or 3 the 741 outputs current at pins 6. This energises the relay. The energised relay activates the counter circuit. Each time the counter circuit is activated it adds a number.

When a 741 Op Amp is used in a circuit like this it is called a 'comparator'.



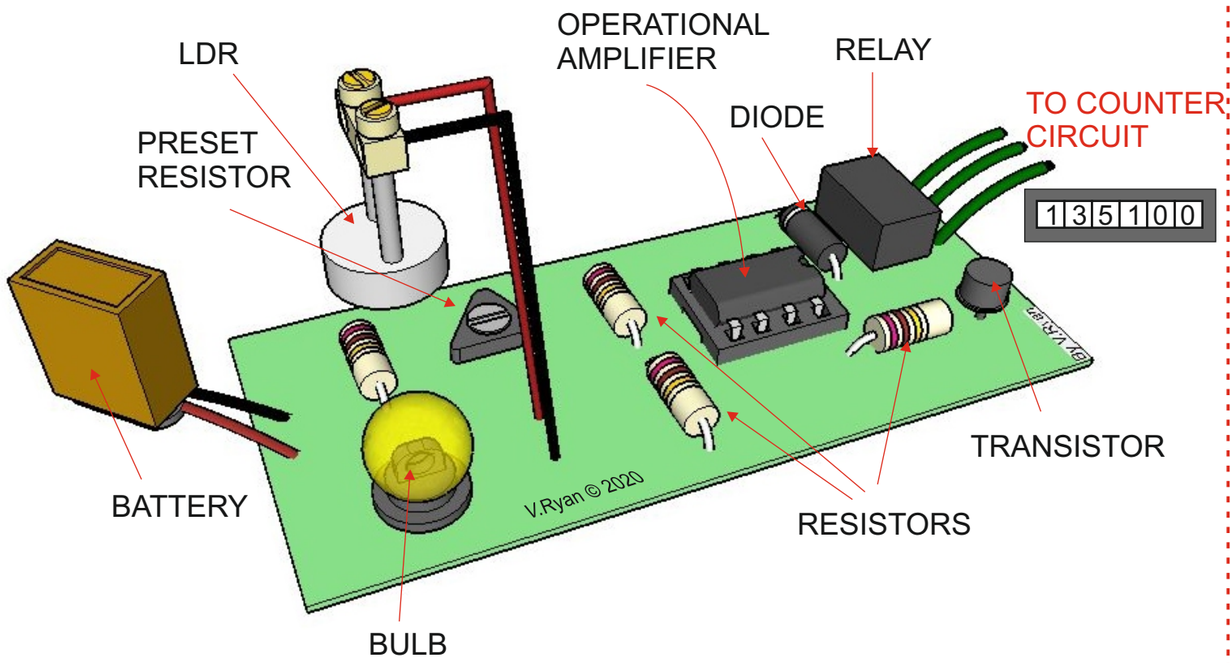
However, there is a fault with the circuit due to the position of the light bulb and LDR. Sometimes the LDR does not detect the light from the bulb. Explain why this may happen and how it could be corrected.

3.WHY THE LIGHT IS NOT ALWAYS DETECTED:

4. HOW THE CIRCUIT COULD BE CORRECTED SO THAT LIGHT IS ALWAYS DETECTED:

5. A 741 Operational Amplifier is represented by a distinctive symbol. Draw the symbol in the space opposite

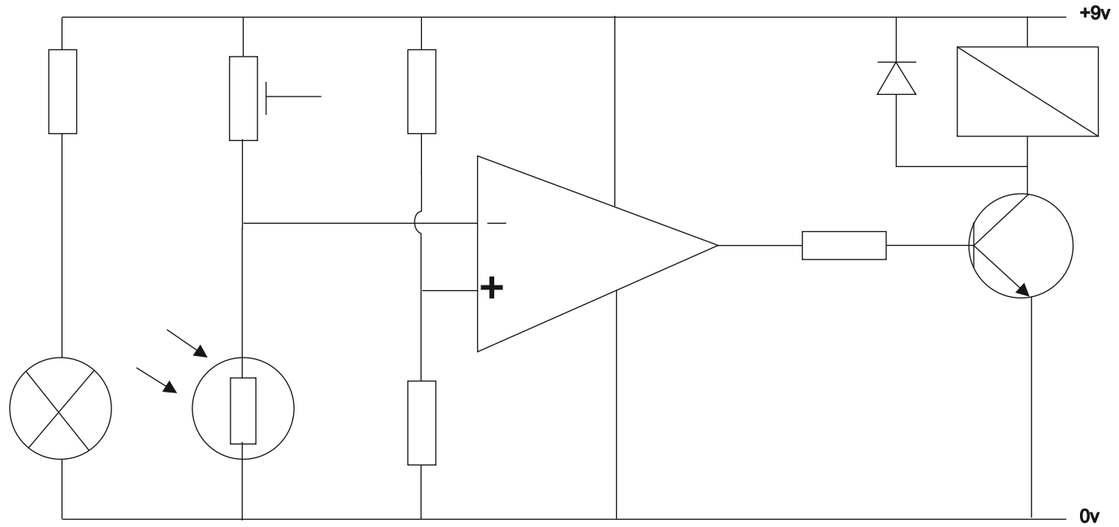
The sensor circuit has been altered slightly and it is now suitable for use in the sensor bracket. The LDR is not soldered directly to the PCB as it is fixed in position with a electrical connector. This means that the LDR is directly above the bulb. As the bulb lights the LDR detects the light immediately.



6. How does the position the LDR in relation to the bulb make the circuit more efficient ?

7. Identify the components listed below (label the components on the circuit diagram) :

Preset Resistor - Op Amp - Diode - LDR - Bulb - Relay



8. Label the 741 Op Amp shown in the circuit above according to the Pin Table shown opposite.

Op Amp Pin Table
1 and 5 = offset null
2 = inverting
3 = non-inverting
4 = 0v
6 = output
7 = +Vcc
8 = NC