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Aim:

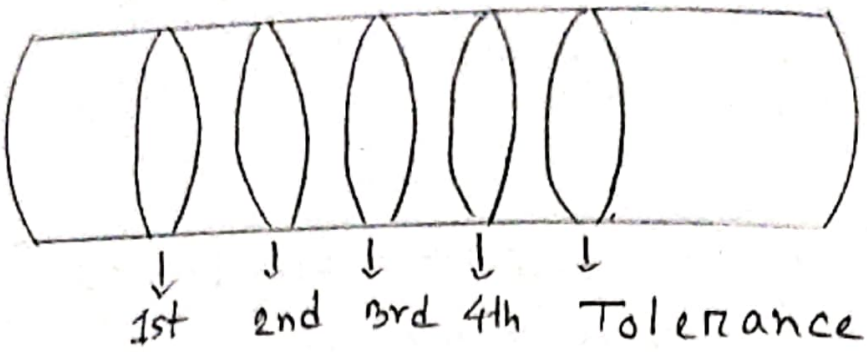
To Conduct an experiment to understand the working Principle of Potentiometer

Components required:

S.NO	Components Name	Quantity
01	Multimeter	01
02	wire	02
03	Bread Board	01
04	Resistor	02
05	Trainer kit	01

Theory:

Colour Resister	1st Band	2nd Band	3rd Band	multiplier	Tolerance
Black	0	0	0	$\times 1$	—
Brown	1	1	1	$\times 10$	1%
Red	2	2	2	$\times 100$	—
Orange	3	3	3	$\times 1000$	—
Yellow	4	4	4	$\times 10^4$	—
Green	5	5	5	$\times 10^5$	—
Blue	6	6	6	$\times 10^6$	—
Violet	7	7	7	-	—
Grey	8	8	8	-	—
White	9	9	9	-	—
Gold	-	-	-	-	—
Silver	-	-	-	-	5%



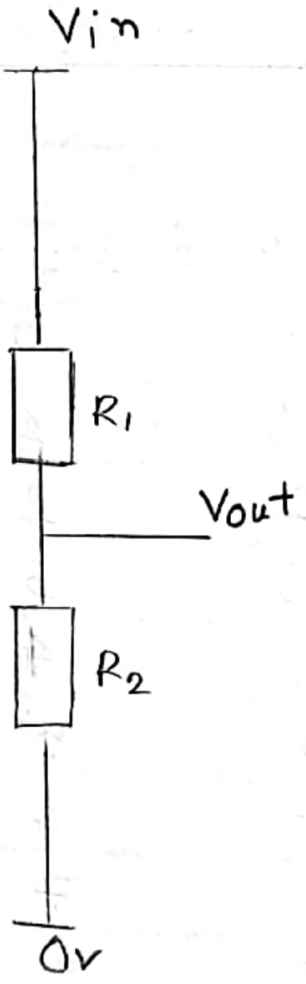


Figure-01

None	-	-	-	-	10%

What is a potential divider or voltage divider?

The voltage difference between any two points in a circuits is knows as potential difference and it is this potential difference which makes current flows.

OR

A potential divider could be thought of as a voltage divider and it is often referred to as such.

A volt is just a unit of 'potential difference' in electric charge between two objects.

The formula for working out the voltage drop across two resistors in series is:

$$Vout = \frac{Vin \times R2}{R1 + R2}$$

One of the most useful ways to use this circuit is replace R0. With a variable register. If R_2 can be controlled by turning a dial then Vout can also be controlled. This is useful for turning or volume control in many circuits such as in our FM radio kit V20 or 3W Stereo Amplifier kit.

Another common use of the potential divider is to replace R_2 with a sensor such as an LDR. Then as the resistor of the sensor changes, Vout changes as

well. This change can be used to trigger a transistor or can be fed into the input of microcontroller.

The unit of potential difference generated between two points is called the volt and is generally defined as being the potential difference dropped accross a fixed resistance of one ohm with a current of one ampere flowing through it.

In other words' 1 volt equals 1 Ampere times 1 ohm, or commonly $V = I * R$.

Ohm's law states that for a liner circuit the current flowing through it is proportional to the potential difference accross it, so the greater the potential difference accross any two points the bigger willbe the current flowing through it.

For Example

if the voltage at one side of a 1Ω register measures 8V and at the other side of the ragistor it measures 5V, then the potential difference accross the resistor would be (8-5) Causing Current of 0.3A to flow

Example:

This is a worked example of using the formula above to calculate the missing Vout value for a circuit.

Look at the circuit (fig.2) and take note

of the values are known. V_{in} is 5 V, R_1 is 1 kΩ and R_2 is 10 kΩ.

Now, substitute the known values into the formula:

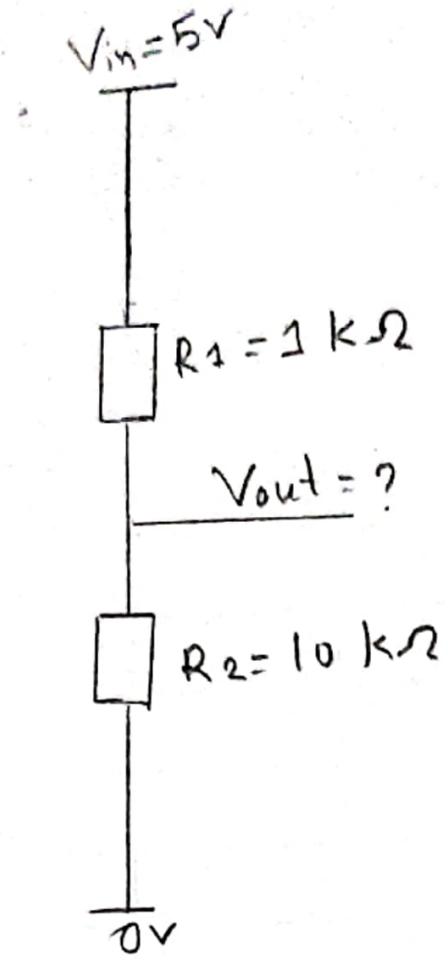


Figure-02

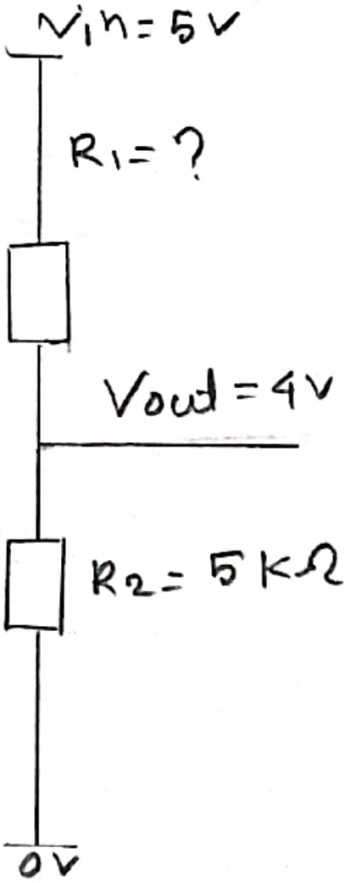


Figure-03

$$V_{out} = \frac{V_{in} \times R_2}{R_1 + R_2}$$

$$= \frac{5V \times 10k\Omega}{1k\Omega + 10k\Omega}$$

$\therefore V_{out} = 4.55V$

Question – 1:- (fig-3)

$V_{out} = 4V$

$V_{in} = 5V$

$R_2 = 5\ k\Omega$

$R_1 = ?$

We know,

$$V_{out} = \frac{V_{in} \times R_2}{R_1 + R_2}$$

$$\text{or, } 4V = \frac{5V \times 5k\Omega}{R_1 + 5k\Omega}$$

$$\text{or, } R_1 = \frac{5V}{4V} = 1.25\ k\Omega$$

Question - 2:- (fig-4)

$$1V = \frac{5V \times R_2}{1k\Omega + R_2} = \frac{1V \times 1K}{5V} = 0.25\ k\Omega$$

Question - 3: (fig-5)

$$V_{out} = \frac{5V \times 1.5K}{1k\Omega + 1.5k\Omega}$$

$$= \frac{7.5\ k\Omega}{2.5\ k\Omega}$$

$= 3V$

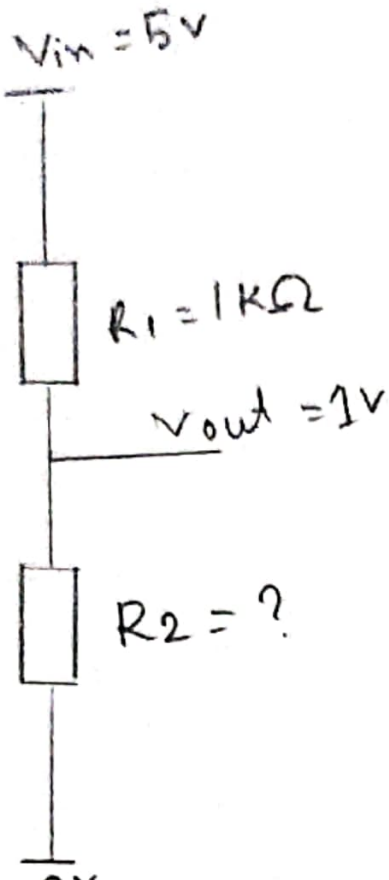


Figure-04

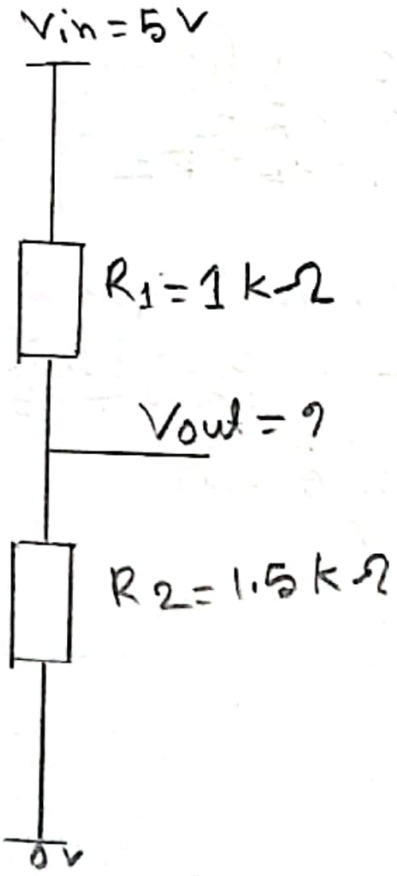


Figure-05

Procedure:-

i) Collect the components necessary to complete the circuit

ii) Connect two register i.e R_1 and R_2 in Series

iii) Connect DC Power supply 5V/10V/12V to one Pin of resistor i.e. R_1

iv) Connect ground (GND) and other terminal of resistor i.e. R_2

v) After finishing the circuit take the reading or noted down the readings from Multimeter.

vi) Repeat the above steps by taking the different resistor values.

From above procedure, we have to find out

$R_1 = 2.4\Omega$

$R_2 = 46.4\Omega$

$V_{in} = 5V$

$V_{out} = ?$

By using formula,

$$V_{out} = \frac{V_{in} \times R_2}{R_1 + R_2}$$

$$= \frac{5 \times 46.4}{2.4 + 46.4}$$

$$= 4.754V$$

Result: Understood the working Principal of Potentiometer and verified successfully.

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Comparator

Aim:- To understand the working Principal of Comparator.

Components Required:-

S.No	Component Name	Quantity
01	IC754 (OPAmp)	1
02	Power supply	4
03	Multimeter	1
04	Connecting wires	-
05	Bread Board	1

Theory:

With reference to the OpAmp comparator circuit that given in figure 1. Let's first assume that VIN is less than the DC voltage level of VREF (VIN) <VREF) As the non-inverting (Positive) input of the comparator is less than the inverting (negative) input, the output will be low and at the negative supply voltage, -Vcc resulting in a negative saturation of the output. If we now increase the input voltage, VIN so that its value is greater than the reference voltage VREF on the inverting input, the input voltage rapidly switches HIGH towards the positive supply voltage, +Vcc resulting in a positive saturation of the output.

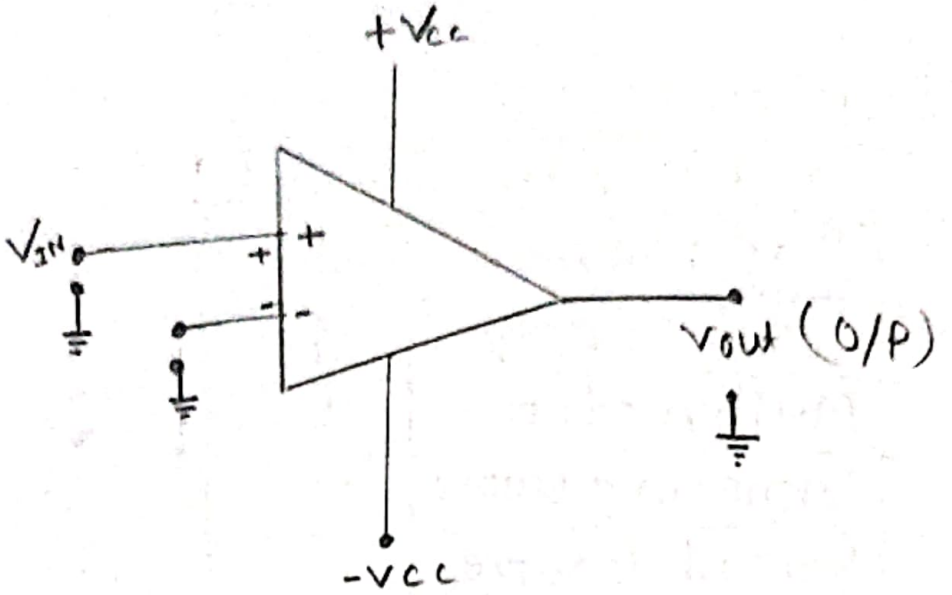
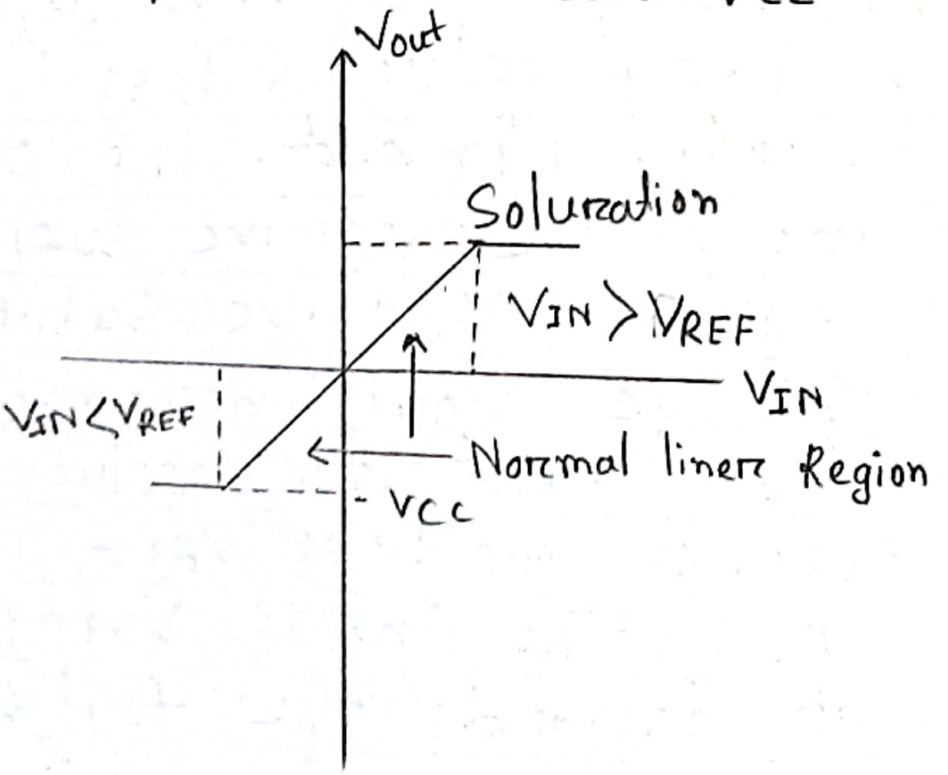


Figure- 01

If $V_{IN} > V_{REF}$ then $V_{OUT} = +V_{CC}$

If $V_{IN} < V_{REF}$ then $V_{OUT} = -V_{CC}$



If we reduce again, the input voltage V_{IN}, so that it is slightly less than reference voltage, the OPAmp's output switches back to it's negative saturation voltage acting as a threshod detector. Then we can see that, the op-amp voltage Comparator is a device whose output is dependent on the value of the input voltage, V_{IN} with respect to some DC voltage level as the output is high. When the voltage on the non-inverting input is less than the inverting input voltage, this Condition is true regardless of whether the input signal is connected to the inverting or the non-inverting input of the comparator.

We can also see that the value of the output voltage is completely dependent on the op-Amps Power supply voltage In theory, due to the op-Amps high open loop gain the magnitude of it's output voltage could be infinite in both directions (±∞).

However Practically, and for obvious reason's it is limited by the op-Amps supply giving.

$V_{OUT} = +V_{CC}$ or $V_{OUT} = -V_{EC}$

Procedure:-

i) First of all, collect all the components necessary to complete the circuit.

ii) Connect IC741 (OPAmp) in Bread Board horizontally.

iii) Ic has 8 Pins but 1 Pin is connected. Connect 4 Powersupply in respect Pins.

iv) Now, Connect, 1st powersupply in In-; 2nd, 3rd and 4th IN+, Power - and Power+ with Positive wire.

v) Connect all the negative wires in ground (Gnd)

vi) Now, Connect Multimeter in output (Positive one) and connect negative to Ground (gnd)

vii) After finishing the circuit take the reading and repeat above steps by taking the different voltage values.

Result:

The comparator circuit was designed and verified successfully.