1430,
TRANSISTORS
EXPERIMENT 1,
UNSTABILIZED CIRCUITS
OBJECTIVES

1. To measure the temperature drift of a transistor
2. To use this measurement for later experiments
INTRODUCTION

We will begin with an unstabilized common-emitter circuit, which is shown on the next slide.

We will be measuring the voltage across the collector resistor, $R_1$. 
EXPERIMENT 1, SCHEMATIC

Potentiometer (on trainer)

\( R_4 \quad 1 \, k\Omega \)

\( R_2 \quad 100k\Omega \)

2N2431

\( R_1 \quad 1k\Omega \)

-10V

+15V

heating resistor

220\( \Omega \)

2W
INTRODUCTION CONTINUED

Using Ohm’s Laws formula, \( I = \frac{E}{R} \), we can take the voltage drop across R1, and divide it by the value of R1 (1kΩ). Remember; a 1V drop across a 1kΩ resistance generates 1 milliampere of current.
So, by using a voltmeter, you can see a considerable change in current as long as you remember $1V/1K\Omega = 1mA$.

If you look at it another way, each milliamp of current flowing through a $1000\Omega$ resistor produces a $1V$ drop in potential.

You should see a considerable change in collector current as the transistor is heated.
PARTS REQUIRED

1 220Ω ½ Watt resistor (red, red, brown)
1 1kΩ, ½ Watt resistor (brown, black, red)
1 100kΩ, ½ Watt resistor (brown, black, yellow)
1 2N2431 Germanium Transistor
PROCEDURE

1. Mount the 220Ω, 2W resistor in the center of the breadboard as shown in the following pictorial.
   a) Mount the 2N2431 transistor so that it touches the top of the resistor
b) Make sure to solder wire posts to the ends of the power resistor.

c) Keep the power resistor above the breadboard

1. Power resistors can become hot enough to damage the breadboard
1430, EXP1, PICTORIAL DIAGRAM

POWER SUPPLY

VOLTAGE

POW GND

NEG

AC VOLTS

OFF

ON

GENERATOR

1kHz

2kHz

FREQUENCY

1X

10X

SINE

GND

SQUARE

1k OHMS

100k OHMS

FOR MORE COURSES WWW.CIE-WC.EDU
2. Identify the leads of the transistor using the diagram below.
2. Continued: If your 2N2431 transistor does not have a dot, hold the transistor up with the leads facing you.

a) Have the base lead, which is the indented middle lead on the left side.

b) The lead above the base is the collector

c) The lead below is the emitter
3. Bend the transistor upward, so it is away from the 220Ω 2W. power resistor.

4. Turn your trainer on and adjust the positive power supply to +15V.
   a) This will heat up the 220Ω 2W. resistor.
4. Continued: Adjust the negative power supply to -10V.
   a) This will bias the transistor.

5. Adjust the 1kΩ potentiometer so you will have +5V across the collector resistor $R_1$.
   a) This will set the original bias current at 5mA.
6. Bend the leads of the transistor so the case, of the transistor, touches the 220Ω resistor.

7. Allow the transistor to heat for 5 minutes.
   a) Measure the voltage across $R_1$ and use Ohm’s law to calculate the collector current and record the calculation in the experiment book where indicated.
CIE RESULTS

We calculated 9.8mA for question 7.

- Due to the differences in individual transistor characteristics, your voltage measurement and then calculation of the Collector current may be substantially different.
DISCUSSION

• This circuit contains no stabilization circuitry. When the transistor was heated, the leakage current increased from 5mA to 9.8mA.

• This represents a change of 96% in the bias current. The calculation is shown next.
96% = \frac{5\text{mA} - 9.8\text{mA}}{5\text{mA}} \times 100\%
QUESTIONS?
RESOURCES

THE END

Developed and Produced by the Instructors in the CIE Instruction Department.

© Copyright 02/2012

All Rights Reserved / Feb. 2012