LEARNING OBJECTIVES
At the completion of this experiment, you will be able to:
- Understand the importance of cutoff and saturation to the operation of a transistor switch.
- Define the purpose of a transistor inverter.
- Identify the function of a transistor switch.

SUGGESTED READING
Chapters 27 and 28, Basic Electronics, Grob/Schultz, twelfth edition

INTRODUCTION
The computers of today do not process numbers in the base 10 (i.e., 0, 1, 2, 3, ..., 9). Computers instead use binary logic of base 2 (0 and 1) to perform their functions. One fundamental circuit is the transistor switch, also known as an inverter. Here, a transistor connected in a common-emitter fashion inverts a signal. That is, if a high-input signal is applied, a low-output signal is created. If a low-input signal is applied, then a high-output signal is created. The circuit of Fig. 27-2.1 is an example of a transistor inverter design.

The circuit of Fig. 27-2.1 is also a transistor switch. In a transistor switch circuit, a voltage level applied to the base terminal will control the potential at the collector. In this fashion, the transistor can be used to turn on or off circuitry connected to the collector. This common-emitter circuit is being switched from cutoff to saturation, as shown in the load line of Fig. 27-2.2.

In this experiment, a transistor will be connected to demonstrate this switching ability.

Fig. 27-2.1 Transistor inverter design.

PROCEDURE
1. Connect the circuit in Fig. 27-2.3. Apply the correct polarity of voltage to $V_{CC}$.
2. Connect point A to ground. Measure and record in Table 27-2.1 the voltage from point B to ground.
3. Connect point A to $+5$ V. Measure and record in Table 27-2.1 the voltage from point B to ground.

Fig. 27-2.2 Cutoff and saturation plotted on a load line.

Fig. 27-2.3 Transistor switch.
4. Connect the circuit of Fig. 27-2.4. Apply the correct polarity of voltage to $V_{CC}$.
5. Connect point A to ground. Measure and record in Table 27-2.1 the voltage from point B to ground.
6. Connect point A to $-5$ V. Measure and record in Table 27-2.1 the voltage from point B to ground.
7. Construct a table of your results that will contrast the two circuits.

Fig. 27-2.4  Transistor switch.
QUESTIONS FOR EXPERIMENT 27-2

1. In the prior circuits, what voltage level would a binary 1 represent? A binary 0? Are the answers the same for both the circuits shown in Figs. 27-2.3 and 27-2.4?

2. What is saturation? How is it demonstrated in this experiment?

3. What is cutoff? How is it demonstrated in this experiment?

4. Are the saturation and cutoff points the same for both the circuits shown in Figs. 27-2.3 and 27-2.4? Do the differences significantly affect overall outcomes? Explain.

TABLE FOR EXPERIMENT 27-2

Table 27-2.1

<table>
<thead>
<tr>
<th>Procedure Step</th>
<th>Function and Measurement</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Point B to ground</td>
<td>_____ V</td>
</tr>
<tr>
<td>3</td>
<td>Point B to ground</td>
<td>_____ V</td>
</tr>
<tr>
<td>5</td>
<td>Point B to ground</td>
<td>_____ V</td>
</tr>
<tr>
<td>6</td>
<td>Point B to ground</td>
<td>_____ V</td>
</tr>
</tbody>
</table>
# EXPERIMENT RESULTS REPORT FORM

<table>
<thead>
<tr>
<th>Experiment No:</th>
<th>Name:</th>
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<tbody>
<tr>
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<table>
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</tbody>
</table>

**Explain the purpose of the experiment:**

**List the first Learning Objective:**

**OBJECTIVE 1:**

After reviewing the results, describe how the objective was validated by this experiment.

**List the second Learning Objective:**

**OBJECTIVE 2:**

After reviewing the results, describe how the objective was validated by this experiment.

**List the third Learning Objective:**

**OBJECTIVE 3:**

After reviewing the results, describe how the objective was validated by this experiment.

**Conclusion:**

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If required, attach to this form: □ Answers to Questions, □ Tables, and □ Graphs.