JAYVEE MAPOTE

JEREMY EDWARD COBAR

LIAN YZABELLE MANALO

MARHU ANDRE MAAÑO

ZIAN OLIVER SALVADOR

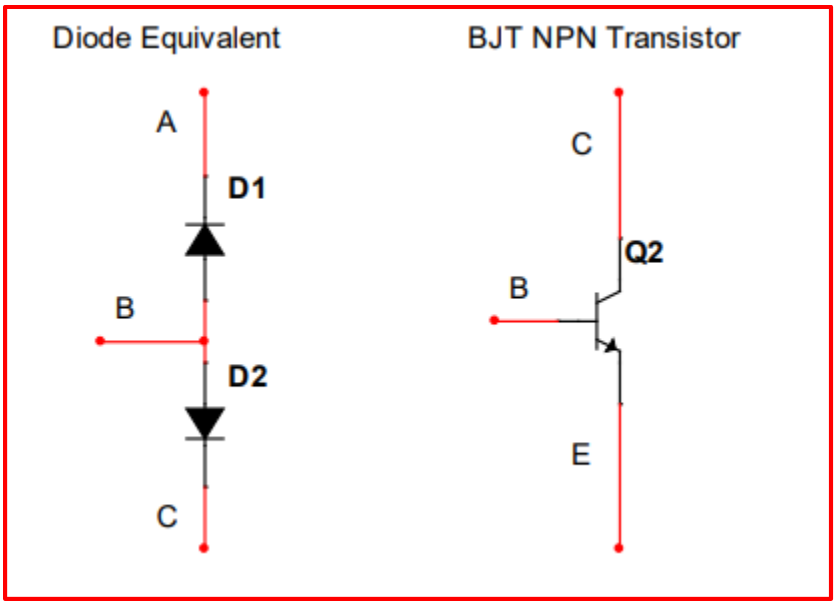
ECE101-1L – FUNDAMENTALS OF ELECTRONIC CIRCUITS (LAB)

Activity #4 and 5: Transistor Familiarization and Application

Objectives:

- Use an Ohmmeter to differentiate between NPN and PNP transistors and to perform operational testing.
- Demonstrate the operation and biasing of a transistor under quiescent conditions.
- Demonstrate how to create and interpret transistor load lines. Procedures:

1. Open Multisim
2. Create the circuit shown below



3. Using a multimeter (Ohmmeter Setting)

a. Connect the Multimeter Probe (+) to B terminal of Diode Equivalent Circuit and Probe (-) to A terminal. Screenshot the Multimeter Reading.

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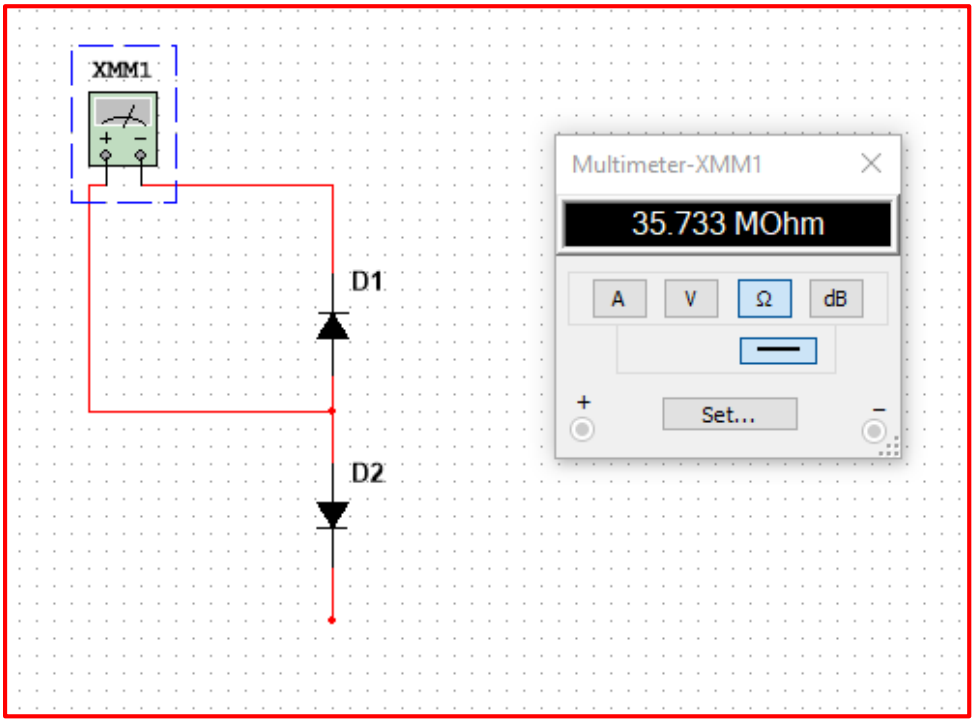
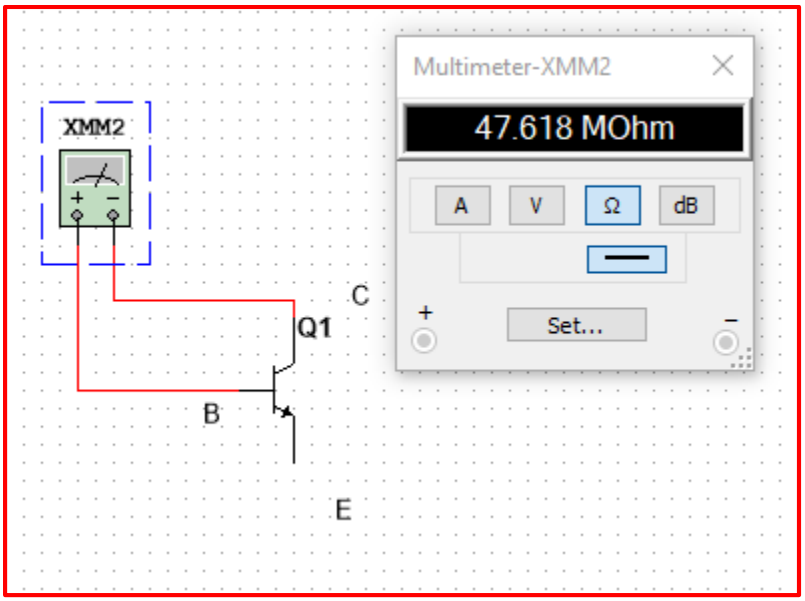


b. Connect the Multimeter Probe (+) to B terminal of BJT Transistor Circuit and Probe (-) to C terminal. Screenshot the Multimeter Reading.



c. Repeat the method used in a and b to complete the table:

JAYVEE MAPOTE

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LIAN YZABELLE MANALO

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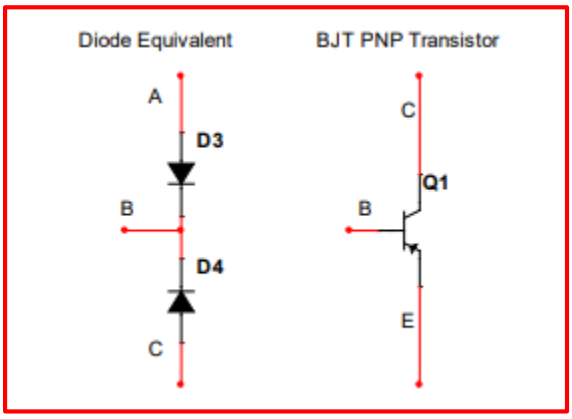
DIODE EQUIVALENT CIRCUIT		
PROBE (+)	**PROBE(-)**	**MULTIMETER READING**
A	B	-r-
B	C	35.733 MOhm
B	A	35.733 MOhm
C	B	-r-
BJT NPN TRANSISTOR		
PROBE (+)	**PROBE(-)**	**MULTIMETER READING**
B	C	47.618 MOhm
B	E	49.386 MOhm
C	B	-r-
E	B	-r-

d. Base on the measurements above compare and discuss the operation of both circuit

4. Create the circuit shown below



5. Using a multimeter (Ohmmeter Setting)

a. Connect the Multimeter Probe (+) to B terminal of Diode Equivalent Circuit and Probe (-) to A terminal. Screenshot the Multimeter Reading

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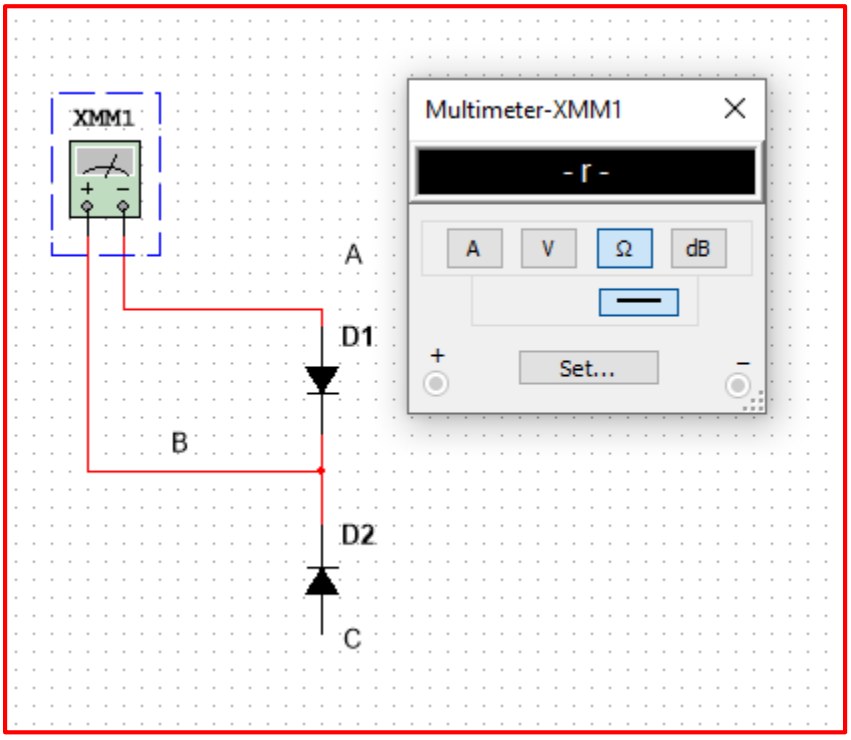

b. Connect the Multimeter Probe (+) to B terminal of BJT Transistor Circuit and Probe (-) to C terminal. Screenshot the Multimeter Reading.

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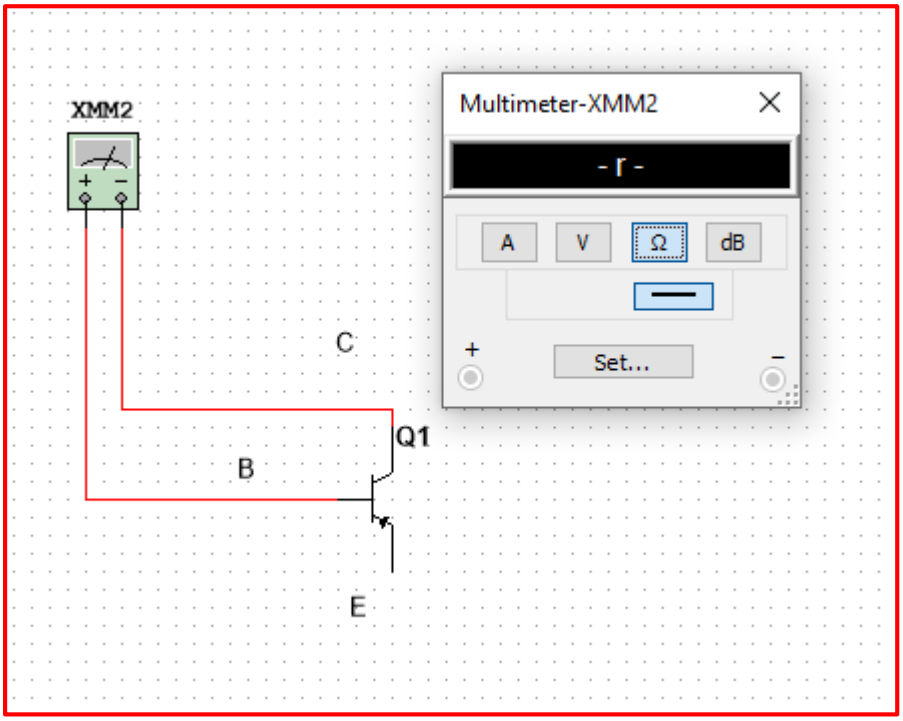

c. Repeat the method used in a and b to complete the table:

DIODE EQUIVALENT CIRCUIT		
PROBE (+)	**PROBE(-)**	**MULTIMETER READING**
A	B	35.733 MOhm
B	C	-r-
B	A	-r-
C	B	35.733 MOhm

BJT PNP TRANSISTOR		
PROBE (+)	**PROBE(-)**	**MULTIMETER READING**
B	C	-r-
B	E	-r-
C	B	47.618 MOhm
E	B	49.385 MOhm

d. Base on the measurements above compare and discuss the operation of both circuit

Based on the measurements above the circuit only operates on certain combinations of connections

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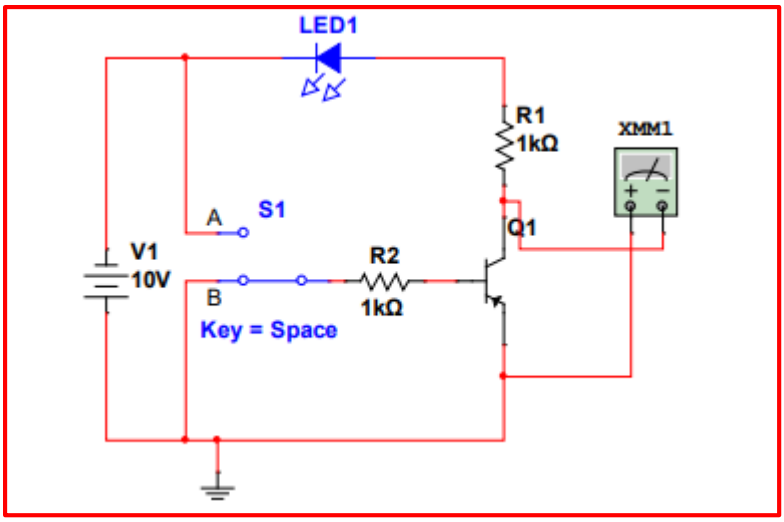
6. Create the circuit shown below



7. Run the Simulation, set the multimeter to Voltmeter settings

a. At S1 at B position what is the Voltage reading in the multimeter

7.7 V

b. By checking the voltage reading and the LED status. Is the circuit conducting or is there a current flowing through the LED?

There's no current flowing through the LED

c. Set S1 at A position what is the Voltage reading in the multimeter

26.098 mV

d. By checking the voltage reading and the LED status. Is the circuit conducting or is there a current flowing through the LED?

There's current flowing through the LED thus, The LED turns on.

8. Create the circuit shown below

9. Place a Multimeter to Measure the

a. Voltage Across the Transistor (VCE) and

b. Current flowing through the emitter (Ie)

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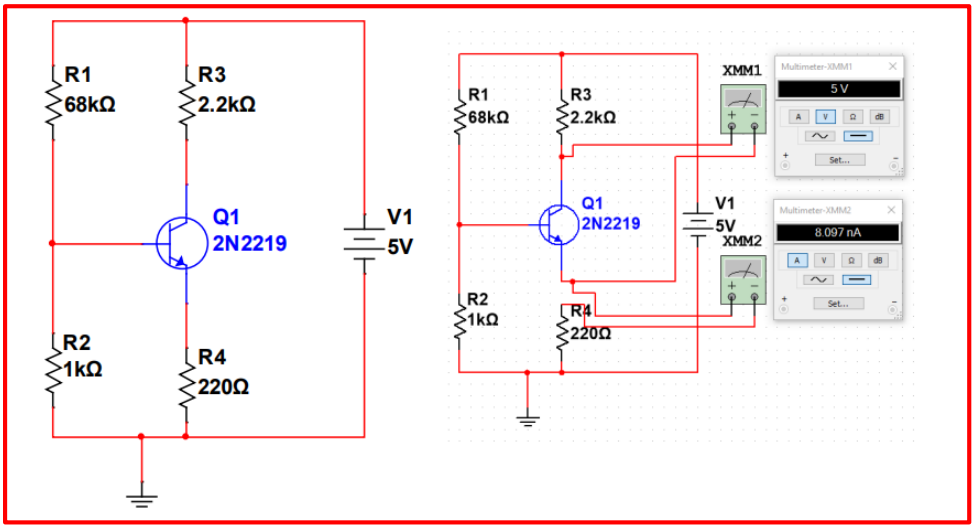

10. Change the Value of R2 and complete the table shown below.

R2(KΩ)	Vce	Ie
1	**5 V**	**5.006 nA**
2	**5 V**	**5.014 nA**
5	**5 V**	**22.672 nA**
8	**4.957 V**	**17.732 uA**
15	**2.607 V**	**992.959 uA**
18	**1.575 V**	**1.422 mA**
20	**949.54 mV**	**1.681 mA**
25	**189.875 mV**	**2 mA**
30	**157.689 mV**	**2.02 mA**

11. Use MSEXCEL or any spreadsheet software to graph the points (Scatter Plots) VCE at horizontal axis and IE at vertical axis

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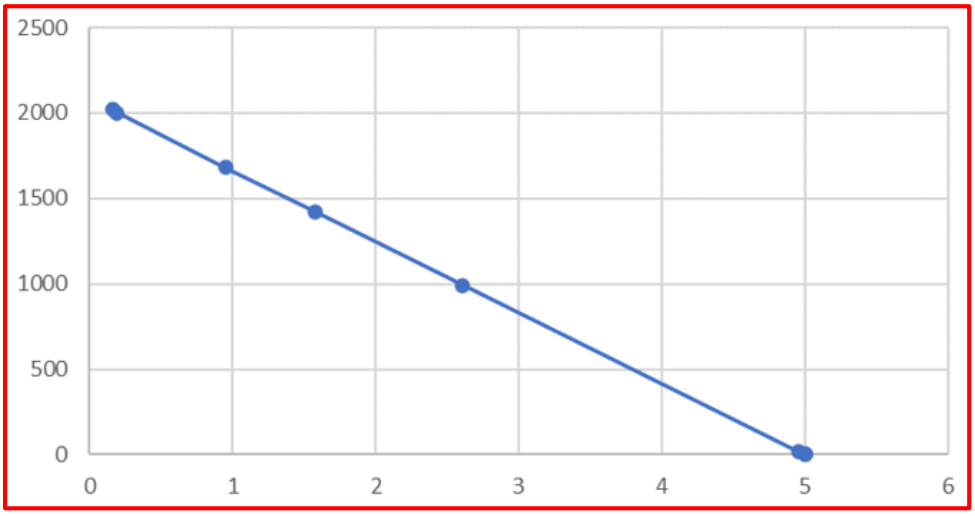
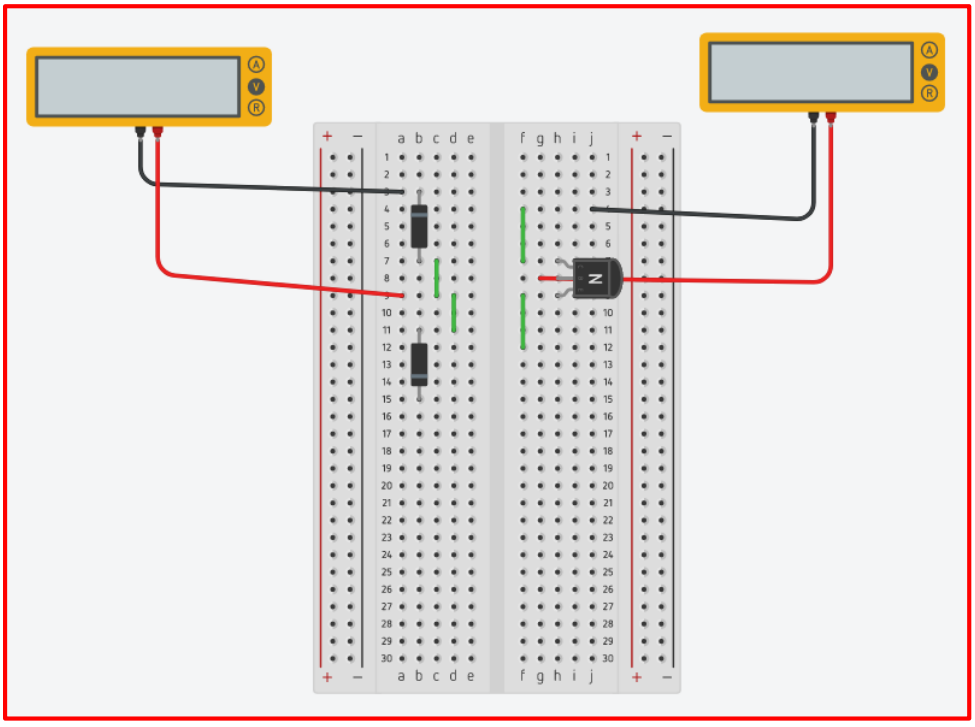


12. Using TinkerCAD

13. Create the circuit shown below



14. Using a multimeter (Ohmmeter Setting)

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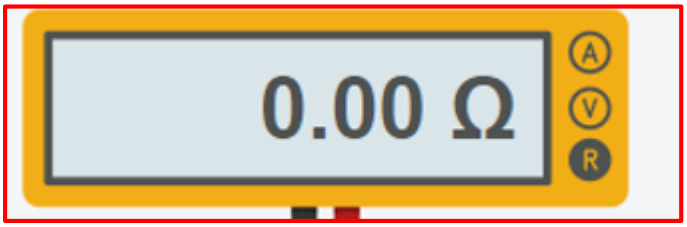
a. Connect the Multimeter Probe (+) to B terminal of Diode Equivalent Circuit and Probe (-) to A terminal. Screenshot the Multimeter Reading.

b. Connect the Multimeter Probe (+) to B terminal of BJT Transistor Circuit and Probe (-) to C terminal. Screenshot the Multimeter Reading.



c. Repeat the method used in a and b to complete the table:

Diode Equivalent Circuit		
Probe(+)	**Probe(-)**	**Multimeter Reading**
A	**B**	**MΩ**
B	**C**	**0 Ω**
B	**A**	**0 Ω**
C	**B**	**M Ω**
BJT NPN Transistor		
Probe(+)	**Probe(-)**	**Multimeter Reading**
B	**C**	**0Ω**
B	**E**	**0 Ω**
C	**B**	**M Ω**
E	**B**	**M Ω**

d. Base on the measurements above compare and discuss the operation of both circuit

The diode Equivaleng circuit and BJT NPN have no connectivity, the mesurment is 0 ohm.

e. Does your TinkerCAD and Multisim simulation generate similar results?

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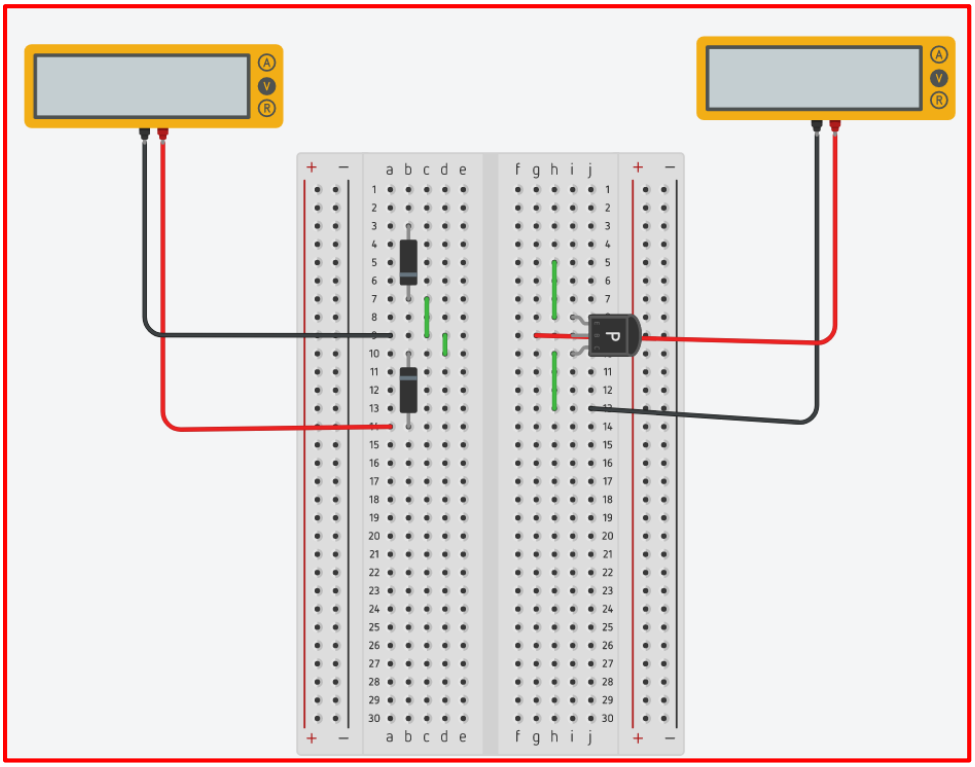
No

15. Create the circuit shown below



16. Using a multimeter (Ohmmeter Setting)

a. Connect the Multimeter Probe (+) to B terminal of Diode Equivalent Circuit and Probe (-) to A terminal. Screenshot the Multimeter Reading.

b. Connect the Multimeter Probe (+) to B terminal of BJT Transistor Circuit and Probe (-) to C terminal. Screenshot the Multimeter Reading.

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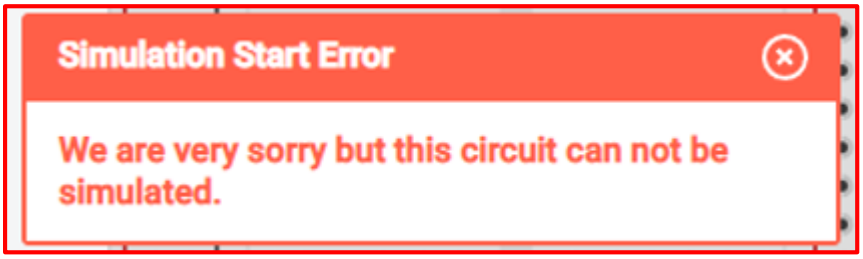

c. Repeat the method used in a and b to complete the table:

Diode Equivalent Circuit		
Probe(+)	**Probe(-)**	**Multimeter Reading**
A	**B**	**0Ω**
B	**C**	**M Ω**
B	**A**	**M Ω**
C	**B**	**0 Ω**
BJT PNP Transistor		
Probe(+)	**Probe(-)**	**Multimeter Reading**
B	**C**	**MΩ**
B	**E**	**Error**
C	**B**	**0 Ω**
E	**B**	**0 Ω**

d. Base on the measurements above compare and discuss the operation of both circuit

The measurement of Diode Equivalent is 0hm therefore no connectivity, its also the same with BJT PNP Transistor.

e. Does your TinkerCAD and Multisim simulation generate similar results?

No

Discussions:

In this experiment it helps us understand more about Bipolar Junction Transistor and the difference of its two classification which is the PNP and the NPN

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