C3

Using a Digital Multimeter

CHAPTER ASSIGNMENT

Name _____ Class _____ No. _____ Date _____

> Answer every question in the space given. Show your working. You may use the chapter page to help you.

Questions from the Guru Jazzy chapter page, for classroom use.

Try it

1. Try it: 555 astable calculator
   f = 1 ÷ (0.693 × (R1 + 2 × R2) × C). Try C = 10 to check the book's 4.81 Hz.

Labs

3.1 Calculate, build and measure a 555 frequency

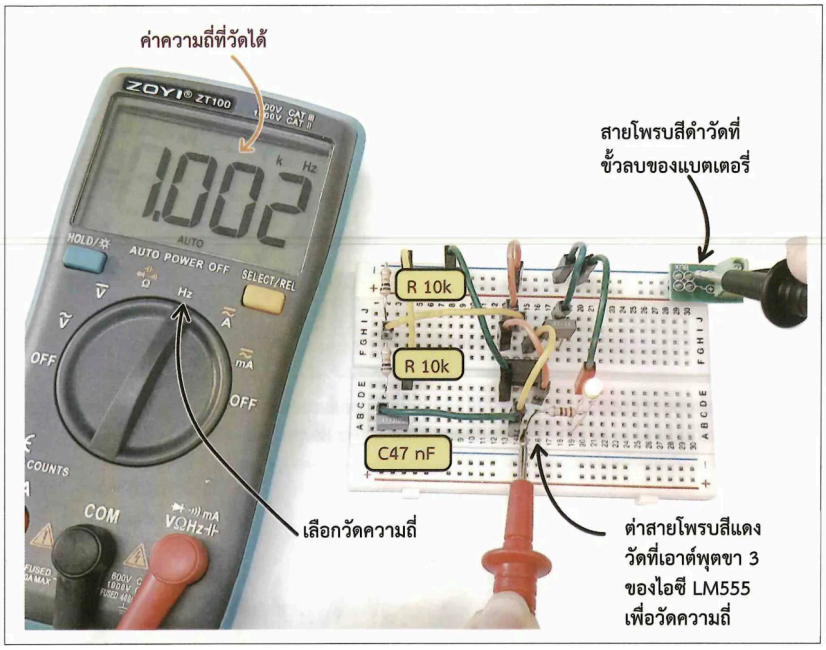
1. On a computer with internet, open a browser and go to the 555 astable calculator at ohmslawcalculator.com/555-astable-calculator (Fig 3-10).

2. Enter the resistors and capacitor and calculate. With **R1 = R2 = 10 kΩ** and **C = 0.047 µF** you get **1.023 kHz**.

3. Build the real circuit (Fig 3-11). Turn the meter to **Hz**, put the red lead on the output (pin 3 of the LM555) and the black lead on ground. The meter shows about **1 kHz**, close to the calculation.

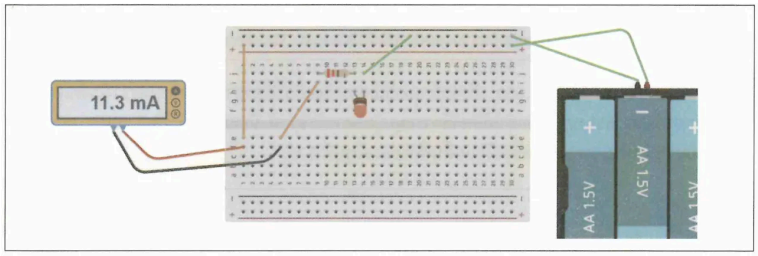
4. Now try a low frequency: change C from 0.047 µF to **10 µF**. The calculator gives **4.81 Hz** (Fig 3-12).

5. Swap the capacitor in the real circuit and measure again. The meter reads close to the calculated value (Fig 3-13).

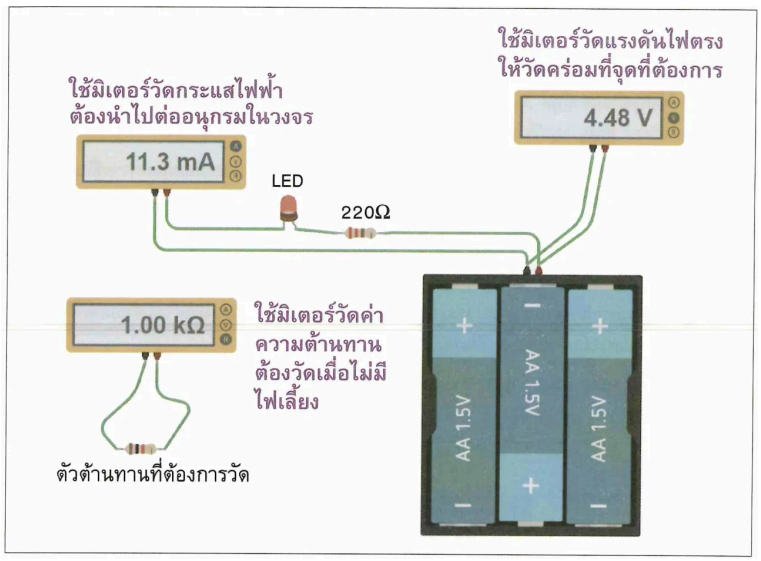


Activity: Measure it in Tinkercad

1 **Current (Fig 3-15):** 3 × AA cells → 220 Ω → LED, with a multimeter in Amperage mode in series. Record the current.



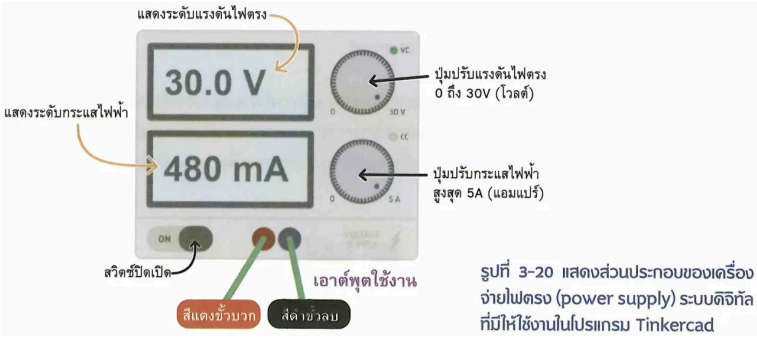
2. **Voltage (Fig 3-19):** add a second multimeter in Voltage mode across the battery pack. Record it.



3. **Resistance (Fig 3-19):** a third multimeter in Resistance mode across a 1 kΩ resistor that is not powered. Then change the resistor to 330 Ω and 4.7 kΩ.

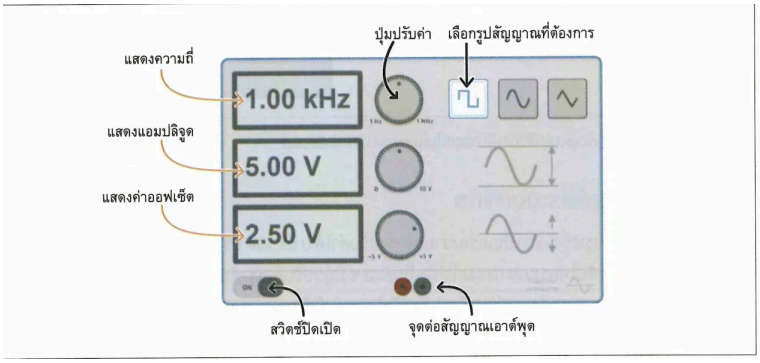
4. **Change the resistor:** replace 220 Ω with 470 Ω in step 1. Predict, then measure: does the current go up or down?

5 **Power supply (Fig 3-20):** replace the batteries with the power supply set to 4.5 V and compare the readings.



รูปที่ 3-20 แสดงส่วนประกอบของเครื่องจ่ายไฟตรง (power supply) ระบบดิจิทัล ที่มีให้ใช้งานในโปรแกรม Tinkercad

6 **Function generator (Fig 3-21):** place one, set 1 kHz square wave, 5 V amplitude and 2.5 V offset, to match Fig 3-21.



Chapter quiz

1 What is the main advantage of a digital multimeter over a needle (analogue) meter?

A	B	C	D
It needs no battery	It shows the value as a number, so there is no scale to read	It reacts faster to changing signals	It can only measure voltage

2 Before measuring a resistor, you touch the two probe tips together. What should the meter show?

A. OL B. Close to 0 Ω C. About 1 kΩ D. 4.5 V

3 An NTC thermistor gets warmer. Its resistance...

A. Goes up B. Goes down C. Stays the same D. Drops to exactly 0 Ω

4 You cover an LDR so no light reaches it. The resistance reading...

A. Rises B. Falls C. Stays the same D. Shows OL straight away

5 In diode test, the red probe is on the anode and the black on the cathode. A good silicon diode reads about...

A. 0 V B. 0.6 V C. 4.5 V D. OL

6 A 555 astable uses R1 = R2 = 10 kΩ. You change C from 0.047 µF to 10 µF. The frequency...

A. Rises to about 4.8 kHz B. Falls to about 4.8 Hz C. Stays at about 1 kHz D. Becomes 0 Hz

7 How must an ammeter be connected to measure current?

A	B	C	D
Across (in parallel with) the part	In series, so the current flows through the meter	Across the battery	With no supply connected

8 You finish measuring current with the red lead in the A socket. What should you do next?

A	B	C	D
Nothing, it can stay there	Move the red lead back to the VΩHz socket	Swap the red and black leads	Take the battery out of the meter

9 When must you measure resistance with the Tinkercad multimeter?

A	B	C	D
While the circuit is powered	With no power connected to the part	Only on AC	Only with the oscilloscope

10 Which Tinkercad instrument gives a sine, square or triangle signal?

A. Multimeter B. Power supply C. Function generator D. Oscilloscope