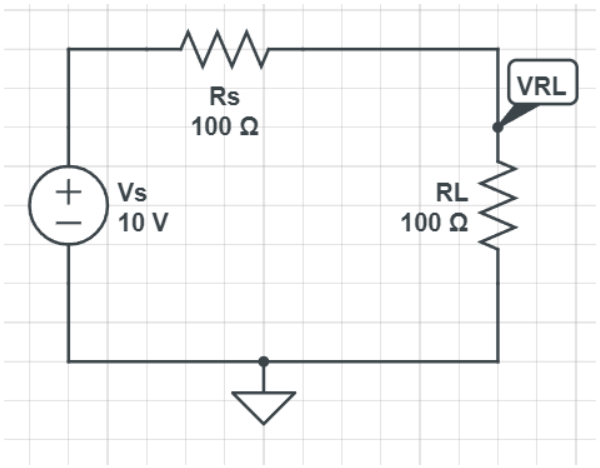
EEP1 ELogBook – Week 5

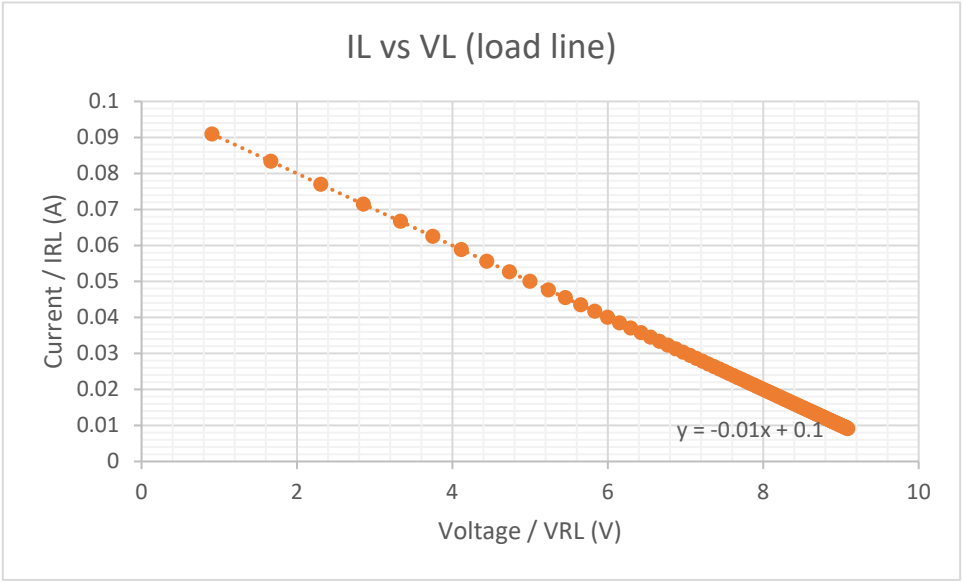
AXXXXXXX - Brians Tjipto Meidianto

Studio

Activity 1

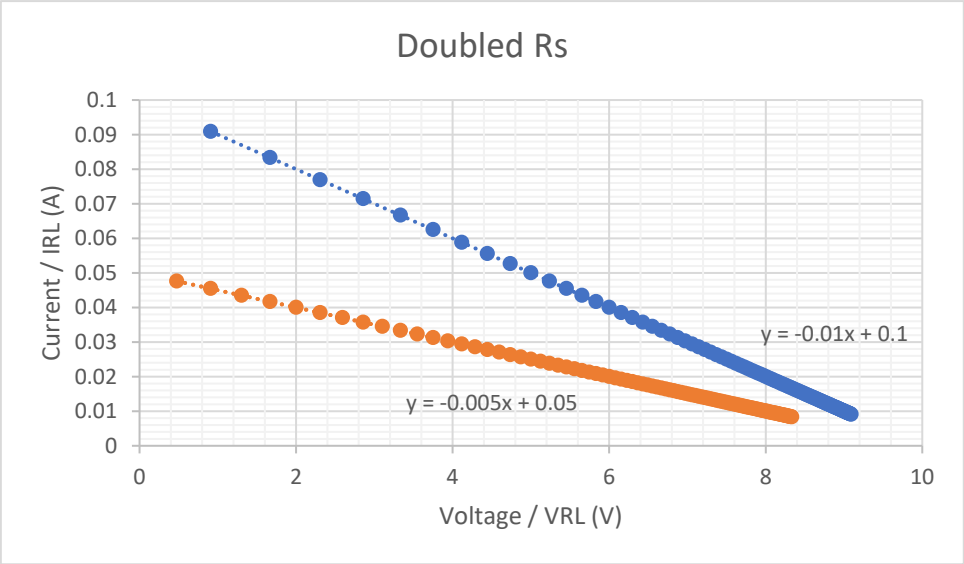


1. IL vs VL (Load line) Graph



2. y = -0.01x + 0.1 / IL = -0.01VL + 0.1
3. Operating points (VL, IL)
    a. RL is removed, VL = 10V, IL = 0A
    b. RL is shorted, VL = 0V, IL = 10/100 = 0.1A

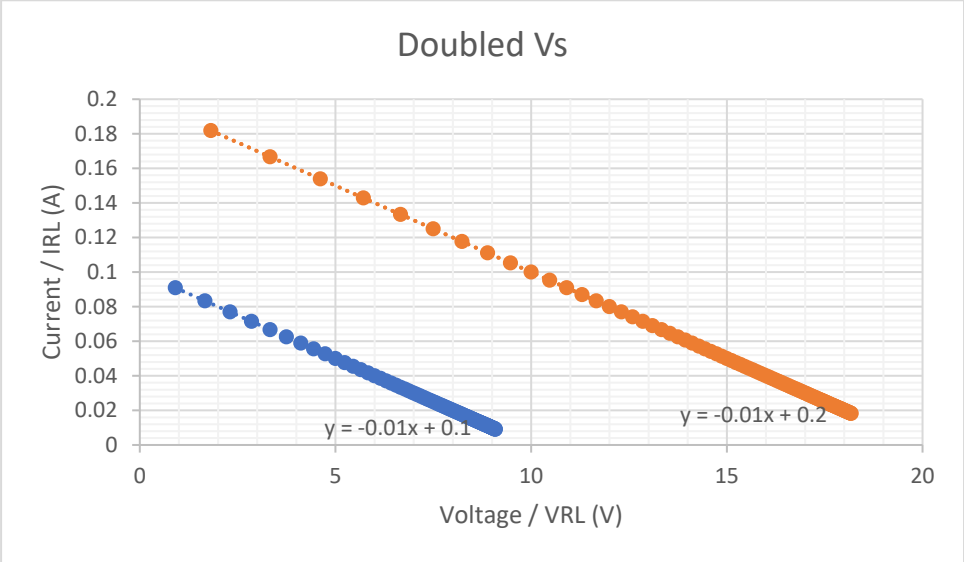
4. Doubled Rs



When Rs is doubled the equations becomes y = -0.005x + 0.05

X intercept: (10,0), Y intercept: (0, 0.05)

5. Doubled Vs



When Rs is doubled the equations becomes y = -0.01x + 0.2

X intercept: (20,0), Y intercept: (0, 0.2)

6. Vd = Vs - Id * Rs

2.546V = 10V - (74.54 mA * 100 ohms)

2.546V = 10V - (0.07454 A * 100 ohms)

2.546V = 10V - 7.454 ohms * A

7.454 ohms * A = 10V - 2.546V

7.454 ohms * A = 7.454V

Rd = (7.454V) / (7.454 ohms * A) = 1 ohm

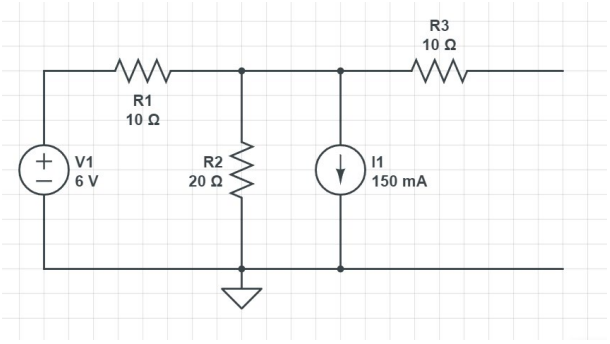
Vd = -(1/rd) * Id + Vs

Vd = -(1/1 ohm) * Id + 10V

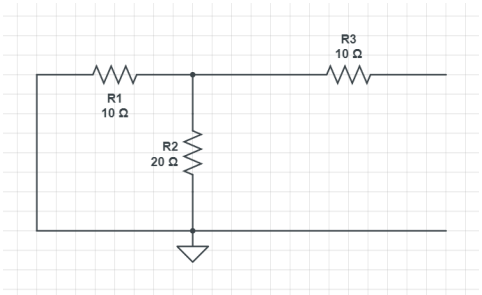
Vd = -Id + 10V

y = -x + 10

Activity 2



1. R_{TH}



R1 and R2 are parallel, while R3 is in series to the parallel resistor.

$$R_{TH} = \frac{R1 \times R2}{R1 + R2} + R3 = \frac{10 \times 20}{10 + 20} + 10 = 16.67\Omega$$

2. V_{TH}

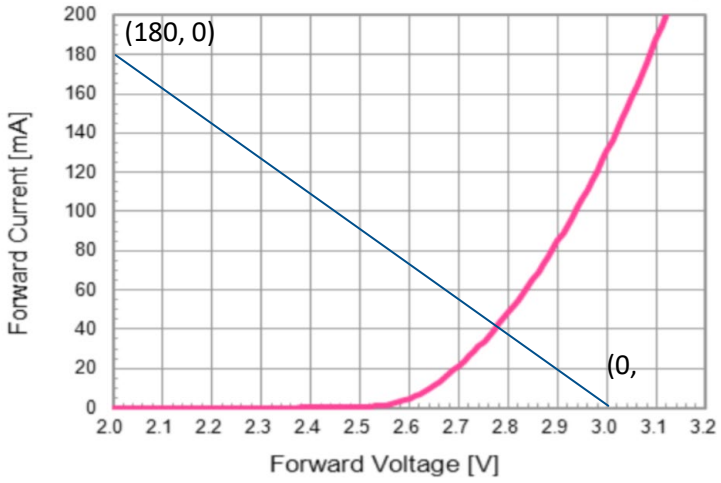
$$\frac{6 - V_{R3}}{10} - 0.15 = \frac{V_{R3} - 0}{20}$$

$$V_{TH} = V_{R3} = 3V$$

3. I_{TH}

$$I_{TH} = \frac{V_{TH}}{R_{TH}} = \frac{3}{16.67} = 0.18A = 180mA$$

Activity 3



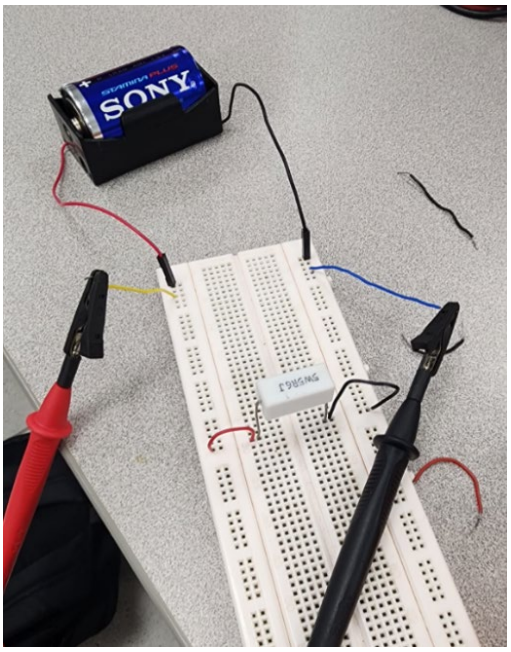
Q Point (Intersection) = 40mA, 2.78V

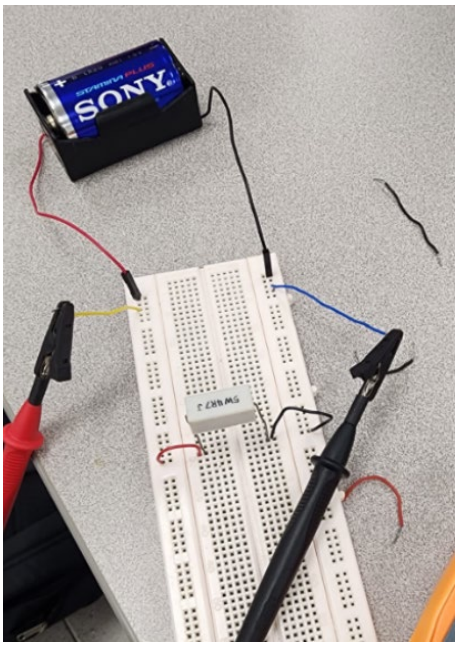
Lab

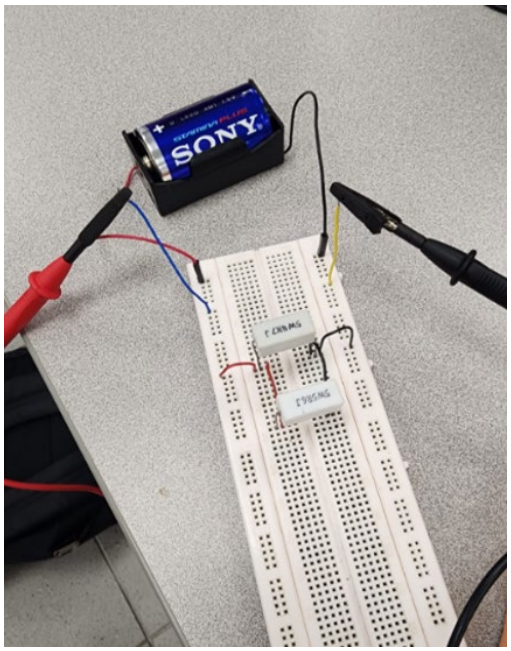
Activity 1

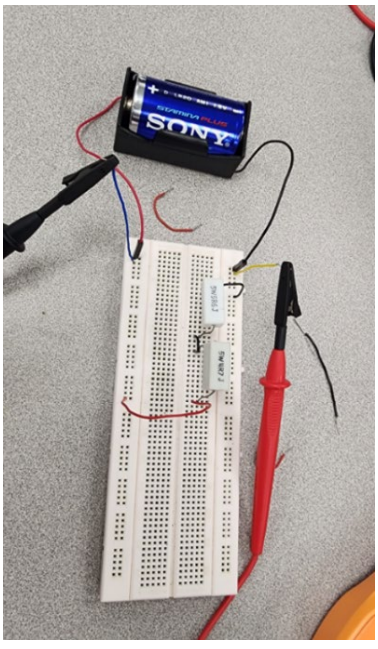
1. Voc = 1.45V
2. IB = VB(1/Rload) + 1/Rload * VB
3. Readings

IB (mA)	VB (V)	RL (Ω)	
111.2	1.39	4.9	5W4R7J
118.4	1.37	5.8	5W5R6J
151.2	1.33	2.7	5W4R7J // 5W5R6J
85.9	1.43	10.6	5W4R7J + 5W5R6J

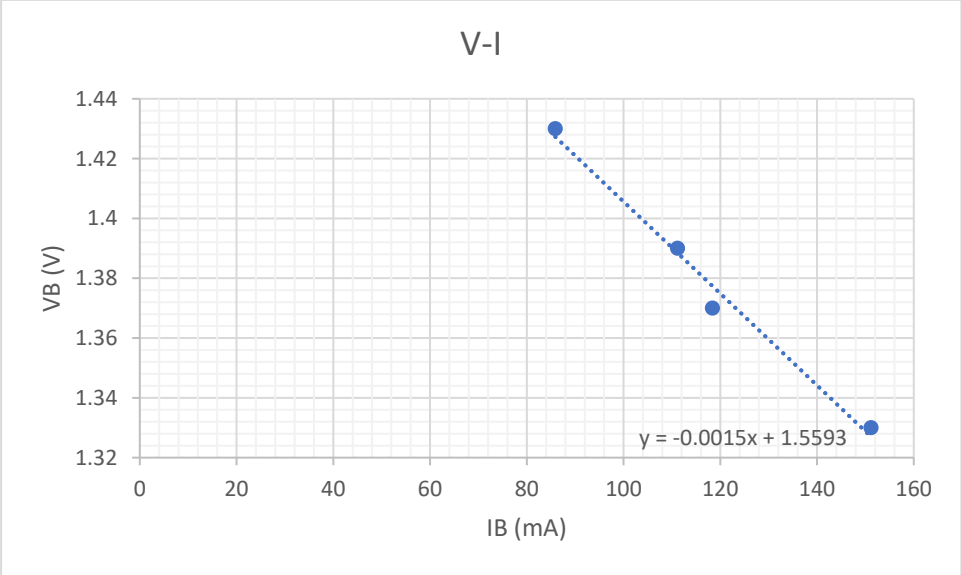








4. Plotted Graph



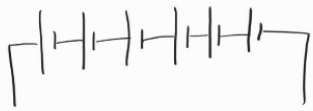
Voc = 1.5593V

I = 1.039A

Rint = 1.5593 ÷ 1.039 = 1.5Ω

Activity 2

6 series – 6S



Voltage: $1.5 \times 6 = 9V$

Capacity: $\left(\frac{1}{5000} \times 6\right)^{-1} = 833.3$ mAh

Energy: $\frac{833.33}{3600} \times 9 = 2.08$ mWh

Resistance: $0.02 \times 6 = 0.12\Omega$

S.D.C: 833.33×0.2
$= 166.67$ mA

6 parallel – 6P

Voltage: 1.5V

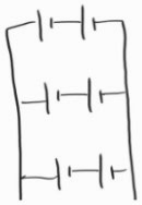
Capacity: 5000×6
$= 30000$ mAh

Energy: $30\,000/3600 \times 1.5$
$= 12.5$ mWh

Resistance: $\left(\frac{1}{0.02} \times 6\right)^{-1}$
$= 3.33 m\Omega$

S.P.C: 30000×0.2
$= 6000$ mA
$= 6A$

2S3P



Voltage: $1.5 \times 2 = 3$

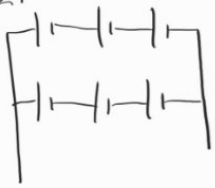
Capacity: $\left(\frac{1}{5000} \times 2\right)^{-1} \times 3$
$= 7500$ mAh

Energy: $7500/3600 \times 3$
$= 6.25$ mWh

Resistance: $\left(\frac{1}{0.04} \times 3\right)^{-1}$
$= \frac{1}{75}\Omega = 13.33 m\Omega$

S.D.C: 7500×0.2
$= 1500$ mA

3S2P



Voltage: $1.5 \times 3 = 4.5V$

Capacity: $\left(\frac{1}{5000} \times 3\right)^{-1} \times 2$
$= 3333.33$ mAh

Energy: $3333.33/3600 \times 4.5 = 4.167$ mWh

Resistance: $\left(\frac{1}{0.06} + \frac{1}{0.06}\right)^{-1}$
$= 0.03\Omega$
$= 30 m\Omega$

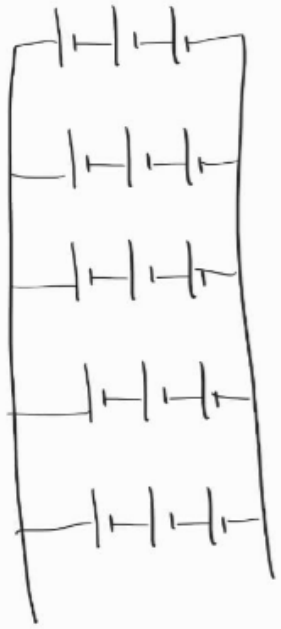
S.D.C: 3333.33×0.2
$= 666.67$ mA

Activity 3

1. 10% left →
   18Wh / 0.9 = 20Wh
   Capacity (Ah) = Total Energy / Voltage
   = 20 / 3.7
   = 5.41 Ah

2. Number of cell
   No. = Required Capacity / 1 cell
   = 5.41 / 0.7 = 7.73
   ≈ 8 cells

3.



Voltage:
11.1 / 3.7 = 3 → series.

Current:
prop total current: 1.6 × 4
= 6.4A

S.D.C = 0.7 × 2 = 1.4A

6.4 / 1.4 = 4.57
≈ 5 → parallel

∴ 3S5P

Practice Problem

EEP1 Wk5 Practice Problem.

1. Q Point → 1.1V & 27mA
   $\frac{2}{33}$ = 60mA → (60,0), (0,2)

2. a) $R_{TH} = \frac{100 \times 100}{100+100} + 20 = 70\Omega$

$V_{TH} = 10 \times \frac{100}{100+100} = 5V$

b) $R_{TH} = 100 + 20 = 120\Omega$

$V_S = 0.1 \times 120 = 12V.$

$V_{TH} = \frac{100}{100+20} \times 12 = 10V$

c) $R_{TH} = 100 + 100 = 200\Omega$
$V_S = 0.1 \times 200 = 20V.$
$V_{TH} = \frac{100}{100+100} \times -20 = -10V$

d) $R_{TH} = \frac{20 \times 5}{20+5} + 4 = 8\Omega$

$\frac{25 - V_{TH}}{5} + 3 = \frac{V_{TH} - 0}{20} \rightarrow V_{TH} = 32V$

e) $R_{TH} = \frac{150 \times 100}{150+100} + \frac{100 \times 100}{100+100} = 110\Omega$

$V_{TH} = V_{AB} = V_B - V_A$
$= \frac{100}{150 \times 100} \times 10 - \frac{100}{100+100} \times 10 = -1V$

f). R_{TH} $\frac{3 \times 6}{3+6} + 2 + 4 = 8\Omega$

↳ $\frac{8 \times 8}{8+8} = 4\Omega$

$V_{R4\Omega} = \frac{12 \times V_{R4\Omega}}{3} + 2 = \frac{V_{R4\Omega} - 0}{6}.$

$V_{R4\Omega} = 12V.$

$V_{TH} = V_{AB} = 12 \times \frac{8}{8+4} = 8V$

3. $R_{TH} = \frac{10 \times 100}{10+100} + 68 = 77.1\Omega$.

$\frac{5 - V_C}{10} + 0.01 - \frac{V_C - 0}{68} = 0. \rightarrow V_C = 4.45V.$

$V_{\text{[illegible]}} = \frac{100}{100 + 68} \times 4.45 = 2.65V$

$I_{\text{[illegible]}} = \frac{2.65}{77.1} = 34.37mA$

(34.37, 0), (0, 2.65)

Q Point → 1.05V, 22mA

Q1 and Q3 Graph