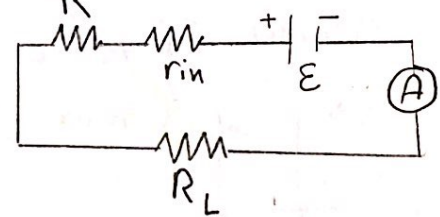


Experiment 2

Source internal resistance, loading Problems And circuit impedance Matching

- **electromotive force (E)**: voltage difference between terminals of an open circuit
- **An ideal voltage source**: ($R=0$) and It provides an almost infinite current-
- **A real voltage source** has an internal resistance r_{in}
- **load**: component that consumes electrical power to produce useful work
- Since r_{in} is very small we add a $1\text{ k}\Omega$ Resistance to it
 $\rightarrow$ So $R_{in} = R + r_{in}$ (shifting)

* loading happens when r_{in} is comparable to R_L (load Resistance)



Power :-

$$P = I^2 R_L$$

Since $I = \frac{E}{R_L + (R + r_{in})}$

$$= \frac{E^2}{(R_L + (R + r_{in}))^2} R_L$$

P is max when :- (by differentiation)

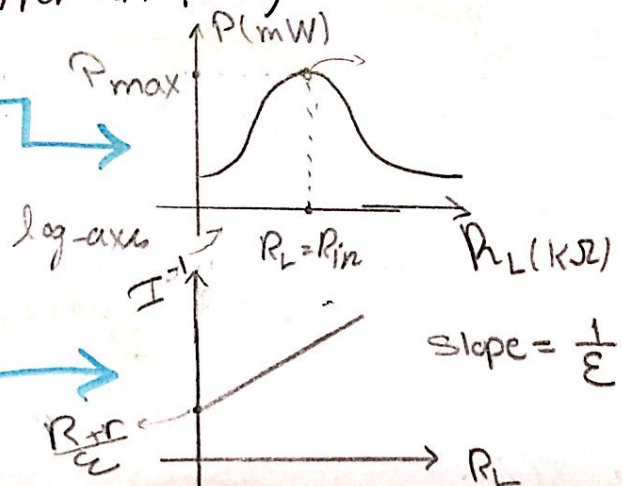
$$R_L = (R + r_{in})$$

$$R_L + (R + r_{in}) = \frac{E}{I}$$

$$\text{So } \frac{R_L}{E} + \frac{(R + r_{in})}{E} = \frac{1}{I} \rightarrow \text{y-axis}$$

x-axis

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- What we need to use :-
 - resistor decade Box
 - Voltage source = 10 V
 - 1 K Ω Resistance
 - Ammeter

Procedure :-

- 1- Change R_L (0.1 --- 40) Ω
- 2- measure I for each value
- 3- Draw I^{-1} vs R_L
- 4- The y-intercept = $\frac{R + r_{in}}{\mathcal{E}}$
 (Note: $r_{in} = 1000 \Omega$ and $\mathcal{E} = 10V$, calculate it)
- 5- The slope = $\frac{\Delta y}{\Delta x} = \frac{1}{\mathcal{E}}$
- 6- Draw P vs R_L (By $P = R_L I^2$)



1- غير المقاومة المتغيرة على مدى $(0.1 - \dots - 40) \Omega$

2- قس التيار لكل قيمة للمقاومة

3- ارسم I^{-1} vs R_L

4- ارسم (مع نسخة خطية) $\rightarrow$

5- المقطع العائلي = $\frac{\text{المقاومة (1 K Ω) + المقاومة الداخلية}}{\text{القوة الدافعة}}$
 (Note: $\rightarrow$ القوة الدافعة $\rightarrow$ مصدر)

6- الميل = $\frac{1}{\text{القوة الدافعة}}$

7- ارسم P vs R_L و قم بإيجاد القوة العظمى من المنحنى

على أن القوة = المقاومة المتغيرة $\times$ (التيار)²

Alaa Etaiwi