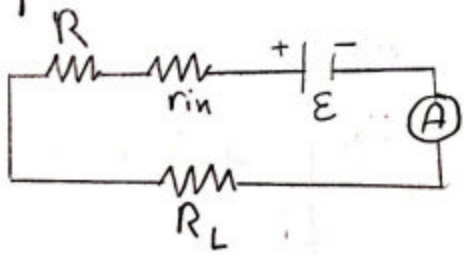
Expirement 2

Source internal resistance, loading Problems And circuit impedance Matching

- **electromotive force (ε)**: voltage difference between terminals of an open circuit
- **An ideal voltage source**: ($R \sim 0$) and It provides an almost infinite current
- **A real voltage source** has an internal resistance r_{in}
- **load**: component that consums electrical power
- Since r_{in} is very small we add a 1 KΩ Resistance to it

→ so $R_{in} = R + r_{in}$ (shifting)

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



Power :-

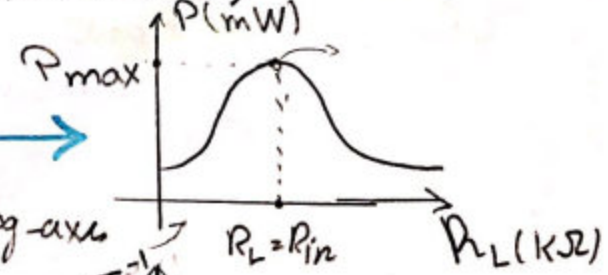
$P = I^2 R_L$

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

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

P is max when :- (by differentiation)

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

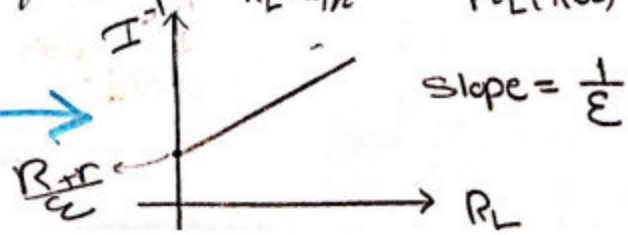


$R_L + (R + r_{in}) = \frac{\varepsilon}{I}$

so $\frac{R_L}{\varepsilon} + \frac{(R + r_{in})}{\varepsilon} = \frac{1}{I}$ → y-axis

x-axis

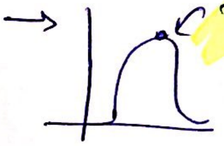
y-intercept



- What we need to use :-
  - resistor decade Box
  - Voltage source = 10 V
  - 1 KΩ 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 = $\frac{R + r_{in}}{\varepsilon}$ (R = 1000 Ω; r_{in} → calculate it; ε = 10 V)
5- The slope = $\frac{\Delta y}{\Delta x}$ = $\frac{1}{\varepsilon}$
6- Draw P vs R_L (By $P = R_L I^2$)

→ 

١- غير المقاومة المتغيرة على مدى (0.1 ---- 40 Ω)
٢- قس التيار لكل قيمة للمقاومة
٣- ارسم I^{-1} vs R_L
٤- المقطع الصادي = $\frac{\text{المقاومة } (1 K\Omega) + \text{المقاومة الداخلية}}{\text{القوة الدافعة}}$
(المقاومة الداخلية → احسبها) (معطى (مع نسبة خطأ)) (القوة الدافعة → معطى)
٥- الميل = $\frac{1}{\text{القوة الدافعة}}$
٦- ارسم P vs R_L ، قم بإيجاد القوة العظمى من المنحنى
علماً بأن القوة = المقاومة المتغيرة X (التيار)²