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# دفـتــر :

# لاب فيزياء (2)

# Physics Lab (2)

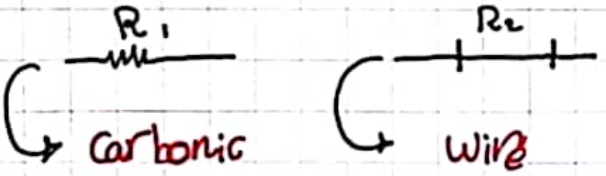
## للطالبة : نور الملكاوي

## للدكتور : أنس الرياحي

اللجنة الأكاديمية لقسم الهندسة الصناعية

2023

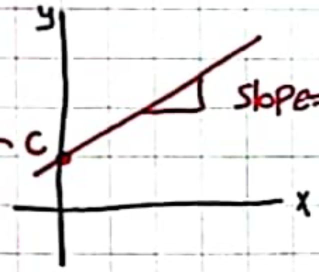
# Experiment(1) : Ohm'S law




Carbonic Resistance — Wire Resistance

* $V = RI$

→ $y = mx + C$ — $V = RI + 0$

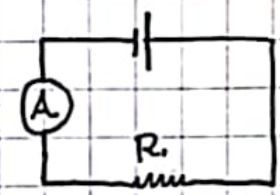



رنها →

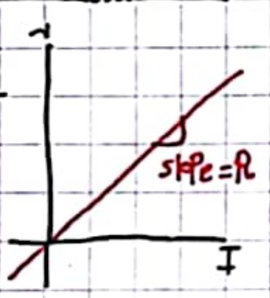
* $[V] = Volt$
* $[I] = Amper$
* $[R] = \Omega$

* لو عكسنا المحاور
  slope = $\frac{1}{R}$

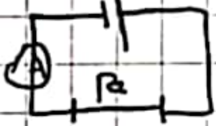
## Part 1



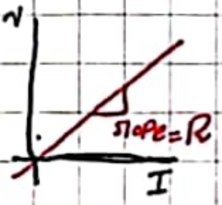

| V | I |
|---|---|
| 0 | – |
| ⋮ | – |
| 10 | – |



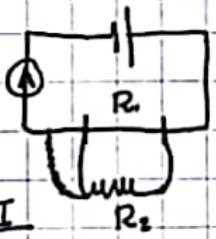

## Part 2



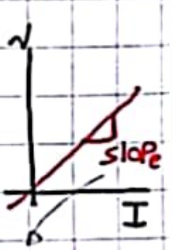

| V | I |
|---|---|
| 0 | – |
| ⋮ | – |
| 10 | – |




## Part 3 parallel : توازي




| V | I |
|---|---|
| 0 | – |
| ⋮ | – |
| 10 | – |

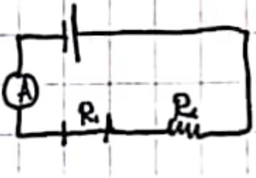


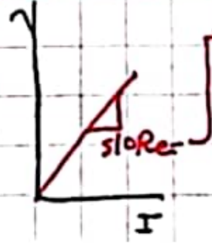

$= R_{total}$

$= \frac{R_1 + R_2}{R_1 R_2}$

## Part 4 series : توالي

| V | I |
|---|---|
| 0 | – |
| ⋮ | – |
| 10 | – |




→ $R_{total} = R_1 + R_2$

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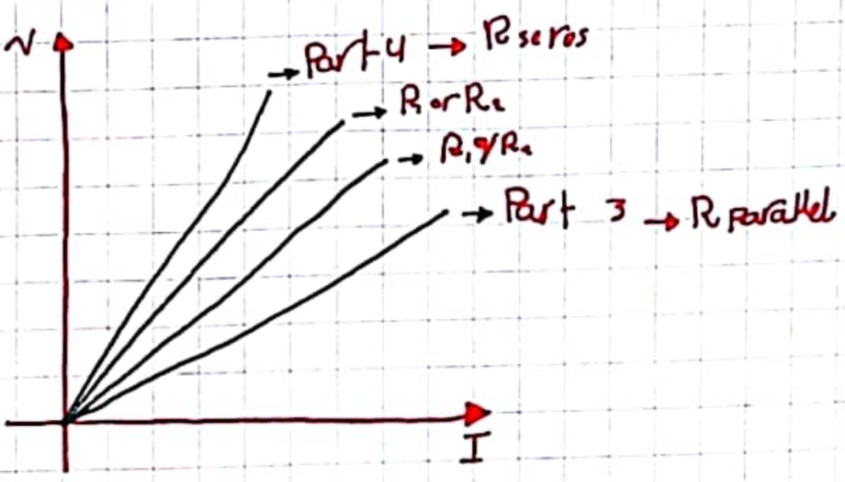
CamScanner




تعتمد على:
نوع المادة، درجة الحرارة

## Part 5

$R = \frac{\rho L}{A}$ :

- $\rho$ = Resistivity $(\Omega . m)$ مقاومية
- A = cross sectional area $(m^2)$
- R = Resistance $(\Omega)$
- L = length

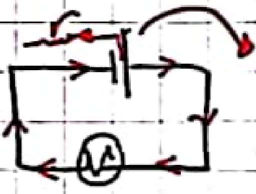
$\rho = \frac{R A}{L}$ → A: $0.1 \times 10^{-6}\ m^2$, L: 1 m → تجربة

* ال اميتر و الجلفانوميتر دائمًا بشبكهم توالي

# Experiment (2) :- Potentiometer → جهاز لتقسيم الجهد

الهدف ✱ to measure unknow battery voltage

قياس بطارية فولتية ما



$\mathcal{E}$ = Electromotive force قوة → volte

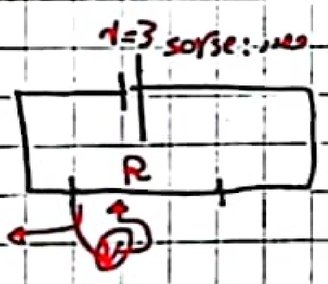
$V = \mathcal{E} - Ir$ → $\mathcal{E} = V + Ir$

$r \neq$ zero

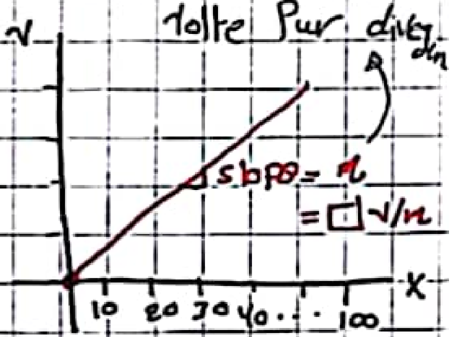
لكن لو الدارة مفتوحة كثير بدنا يكون $V = \mathcal{E}$ ومنها → I = zero لم قطع سلك

✱ We have to measure ($\mathcal{E}$) by using Pot. with comparison.

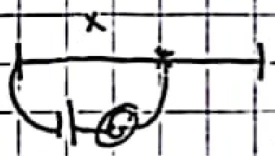
## Part 1



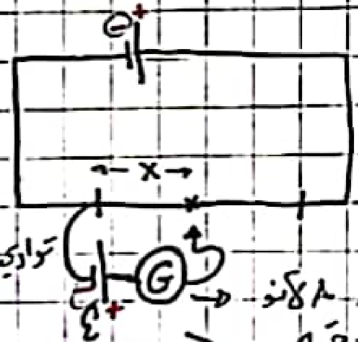

| x | V (v) |
|---|---|
| 0 | 0 |
| 10 | . |
| 20 | . |
| 30 | . |
| ⋮ | |
| 100 | . |




Slope ✱ x = V



## Part 2



O = G تساوي صفر

→ I = 0

قيمة الأنو دقة.

✱ أهملنا المقاومة الداخلية لأنه التيار الجاري فيها يساوي zero

$V$ = slope ✱ $x$ = $\mathcal{E}$

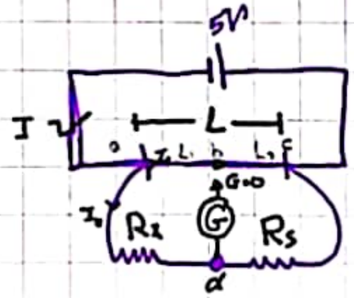
$\mathcal{E}$ = slope ✱ $x$

✱ Polarity for $\mathcal{E}$ → وصيل بنفس الشحنة

✱ V for battery (source) most be > $\mathcal{E}$

الجزء الاهم لك عندنا الانحراف zero يعني (أقل ما يمكن).

# Experiment (3) 8 Wheatstone Bridge :-




$I = 0$

$\Delta V_{bd} = 0$ ↰ so

$V_{ab} = V_{ad}$ → $I_1 R_1 = I_2 R_x$ ... ①

$V_{bc} = V_{dc}$ → $I_1 R_2 = I_2 R_s$ ... ②

← $\frac{①}{②}$

$$\frac{I_1 R_1}{I_1 R_2} = \frac{I_2 R_x}{I_2 R_s}$$

$R_1 = \frac{\rho L_1}{A_1}$

→ $\frac{R_x}{} = \frac{R_1}{R_2} R_s$

$R_2 = \frac{\rho L_2}{A}$

$$R_x = \frac{\frac{\rho L_1}{A}}{\frac{\rho L_2}{A}} R_s \rightarrow \boxed{\frac{R_x}{R_s} = \frac{L_1}{L_2}}$$

| $R_s$ | $L_2$ (cm) | $L_1$ (cm) | $\frac{L_1}{L_2}$ | $R_s \frac{L_1}{L_2} = R_x$ |
|---|---|---|---|---|
| 10 | | | | |
| 20 | | | | |
| 30 | | | | |
| : | | | | |
| 100 | | | | |

$$\rightarrow \overline{R_x} = \frac{R_{x_1} + R_{x_2} - - -}{\square}$$

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CS CamScanner

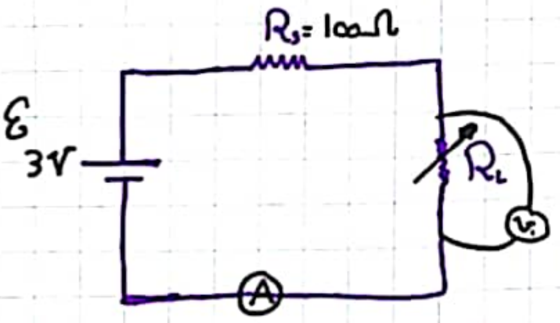
# Experiment (4): Power transfer

$P = I^2 R$

$[P] = A \cdot V = W \rightarrow$ واط

$P = \frac{V^2}{R}$

$P = IV$




$10\Omega \rightarrow 100\Omega$

* Load Resistance:

هدف * To determin the power dissipated (مستهلكة) on $R_L$

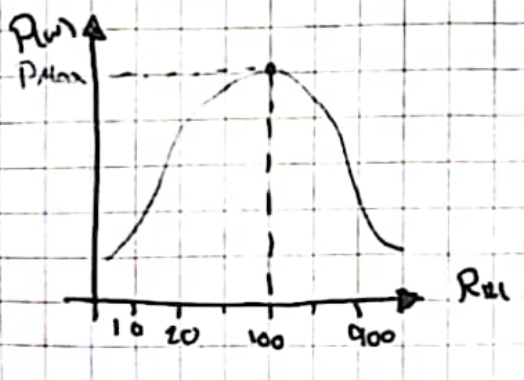
* To find the maximum power dissipated.

* اذا بدي $P_L$ بحتاج بدي $R_L$ و $V_L$ و $I_L$

| $R_s$ | $R_L$ | $V_L$ | $I_L$ | $P = V_L I_L$ |
|---|---|---|---|---|
| 100 | 10 | - | - | - |
| 100 | 20 | - | - | - |
| 100 | 30 | - | - | - |
| ⋮ | ⋮ | | | |
| 100 | 100 | | | هنا بيكون Maximum Power |
| 100 | 200 | | | |
| ⋮ | ⋮ | | | |
| 100 | 900 | | | |

* Maximum power dessipated occures when $R_s = R_L$

$P_{max} \rightarrow R_L = R_s$




$I = \frac{V}{R}$ ← من قانون اوم

$V = IR \rightarrow \varepsilon = I(R_s + R_L)$

$\varepsilon = 2IR_L$

$I_{max} = \frac{\varepsilon}{2R_L}$

$P_{L_{Max}} = \frac{\varepsilon^2}{4R_L}$

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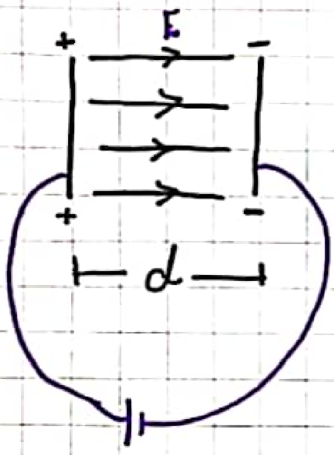
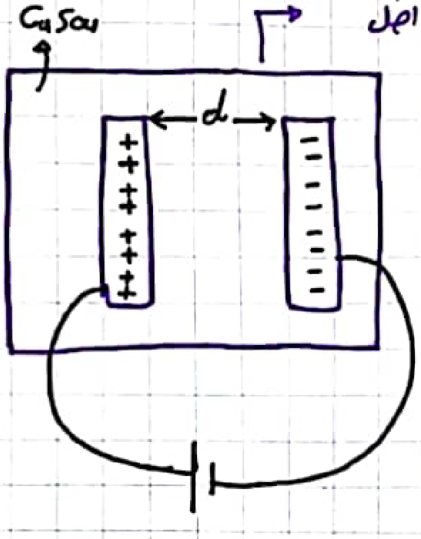
# Experiment (5): Electric fild Mapping:-

$V = Ed$



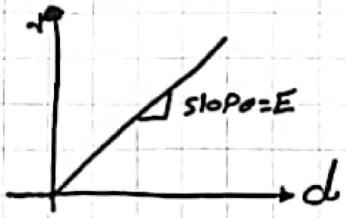

دائما بنقيس للمسافة من داخل




$V = Ed$

$y = mx + c$

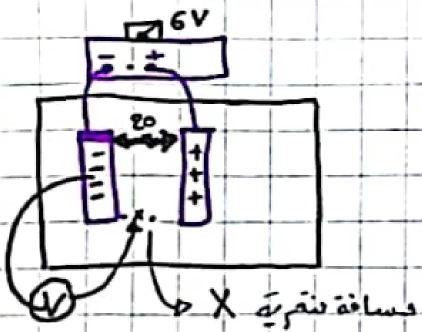
$V = Ed + 0$

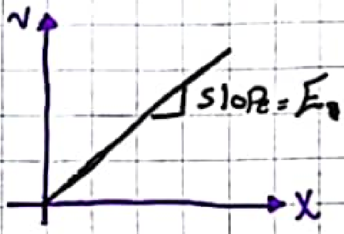



## Part (1)

① $d = 20\,cm$

| x | V |
|---|---|
| 0 | — |
| 4 | — |
| 8 | — |
| 12 | — |
| 16 | — |
| 20 | — |

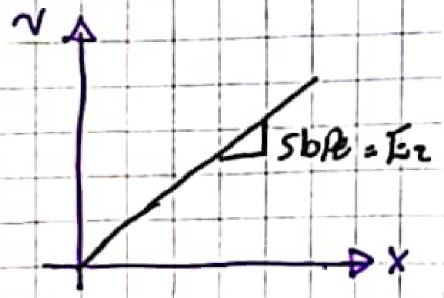



## Part (2)

→ (d=15) نقيس بنفس الطريقة ولكن الفرق

| X | V |
|---|---|
| 0 | — |
| 3 | — |
| 6 | — |
| 9 | — |
| 12 | — |
| 15 | — |

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تكملة   Experiment (5)   [ E.F.M ]

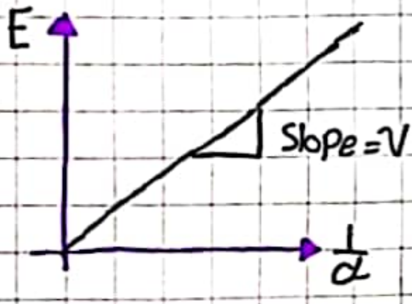
* .برجعوا بنقيس وبنوصل بنفس الطريقة لكن ($d = 10$ cm) ⑨

| x | V |
|---|---|
| 0 | – |
| 2 | – |
| 4 | – |
| 6 | – |
| 8 | – |
| 10 | – |

كلما كانت $d$ اصغر $E$ بتكبر عشان $V$ تضل ثابتة.

## Part 2

$V = Ed \rightarrow E = V\frac{1}{d} \rightarrow y = mx$



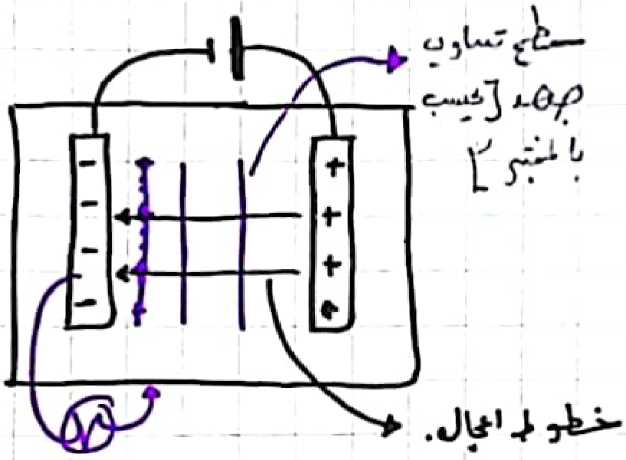

| E | d | $\frac{1}{d}$ cm |
|---|---|---|
| $E_1$ | 20 | $\frac{1}{20}$ |
| $E_2$ | 15 | $\frac{1}{15}$ |
| $E_3$ | 10 | $\frac{1}{10}$ |

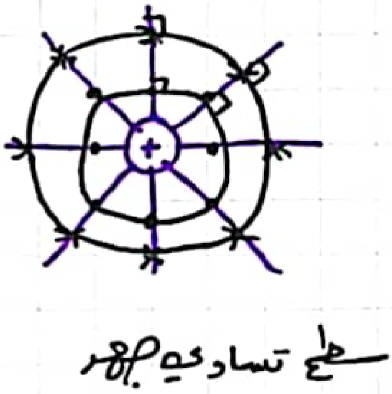
* ملاحظة : المفروض ان يكون الميل الذي تم ايجادة هو نفسه الجهد المستخدم في المصدر .

تكملة Experiment (5) [E.F.M]

Part 3

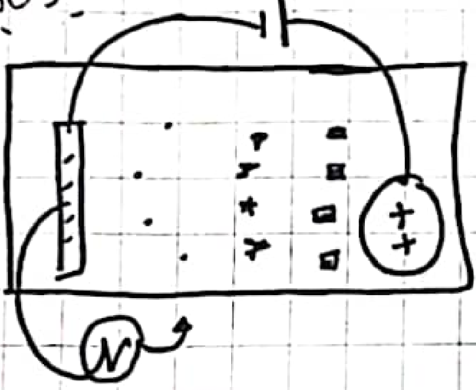
[1]



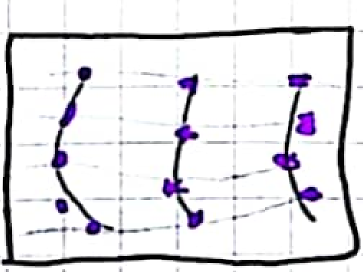




٥٠٪ يعني جهد القلم يظل ثابت

[2]



برسم على ورقة شكل ناتج تقريباً

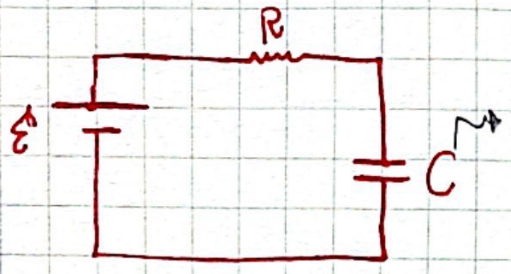


← تسمى سطوح تساوي جهد وليس خطوط لكننا لأنه نتعامل خطط ببعدين فستظهر كأنها خطوط .

# Experiment (6) : RC Circuit

يوصل الدارة

① R → Resistor , ② C → capacitor




لتخزين الشحنات

① Charging شحن , ② dis charging تفريغ

[1] → $I = I_0 e^{-t/\tau}$ → 

- $I_0$ → current at $t=0$
- $I$ → current at any $t$
- $\tau = RC$ → time const → $\Omega . F = S$ ثانية
- $t$ = time (s)

charging

(A) $t=0$

↳ $I = I_0 e^{-t/\tau}$ → $I = I_0$ → $I_0 = \frac{\varepsilon}{R}$ (مهمل مقاومة r او داخلية)

(B) $t = \infty$ (زمن كافي)

↳ $I = I_0 e^{-\infty/\tau}$ → $I = I_0 \left(\frac{1}{\infty}\right)$ zero → $I$ = zero

→ fully charged capacitor → بتصير بنفس جهد البطارية

ويعكسها بالإشارة ف كأنها دارة مغلقة عشان هيك $I=0$

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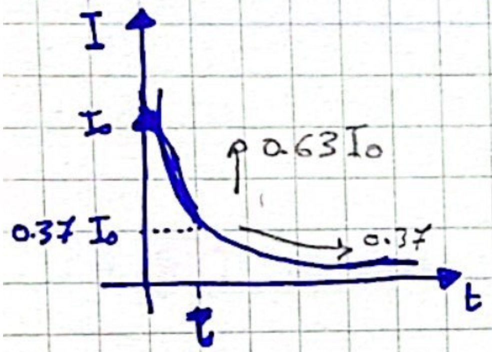
(C) $t = \tau = CR$

$\hookrightarrow I = I_0 e^{-\tau/\tau} \rightarrow I = I_0 e^{-1}$

$\hookrightarrow I = 0.37 I_0$

لـ معناها نزول في تيار لم يتبقى عنده الا 0.37 منه التيار الاصلي

بعد $t = \tau$




(D) $t = t$

$\hookrightarrow I = I_0 e^{-t/\tau}$ اي زمن

$I_0 = \frac{\mathcal{E}}{R}$

$\hookrightarrow IR = V = \mathcal{E} e^{-t/\tau}$

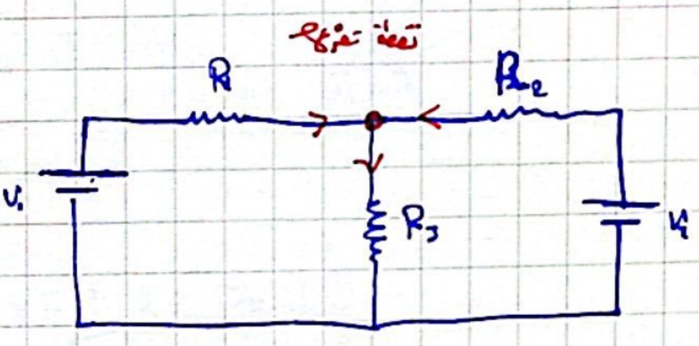
* لو دخلنا ln للمعادلة الاساسية بتصير :-

$t = -\tau \ln\left(\frac{I}{I_0}\right) + 0$

$y = m x + C$

Slope $= -\tau$

# Experiment (7) : Kirchhoff's Rules.

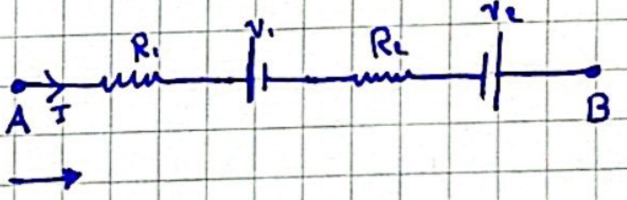



لا يمكن حله عن طريقة
التوالي والتوازي
في هذه الحالة بستعمل قوانين
كارشوف

① $\Sigma I_{in} = \Sigma I_{out}$

← مجموع كل التيارات داخلة = كلها خارجة
على الأقل لازم واحد داخل وواحد خارج.

② $\Sigma V_{\text{closed loop}} = 0$




* مشيت مع التيار بوضع V سالبه يعني $-IR$ مشيت العكس بكون موجب
$+IR$

* اما البطارية مشيت من سالب للموجب بوضعها موجب والعكس سالب

* $V_A - IR_1 - V_1 - IR_2 + V_2 = V_B$

↳ $IR_1 + V_1 + IR_2 - V_2 = V_A - V_B \longrightarrow$ لو مغلقة رح تكون $V_B = V_A$
بالتالي = صفر

* ال Jamper بستخدمه عشان افصل جزء من الدارة او اركبه امتى.

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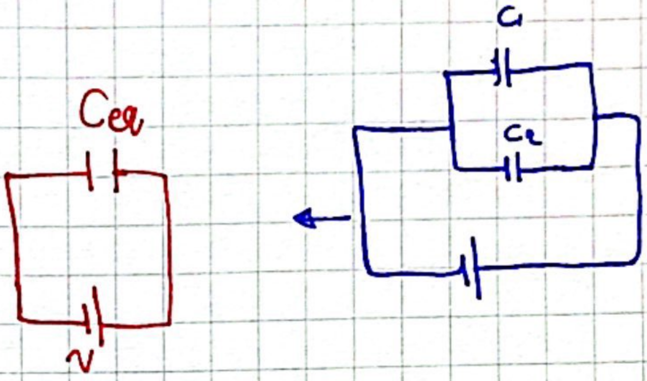
# Eperiment (8): Capacitors in series and parallel.

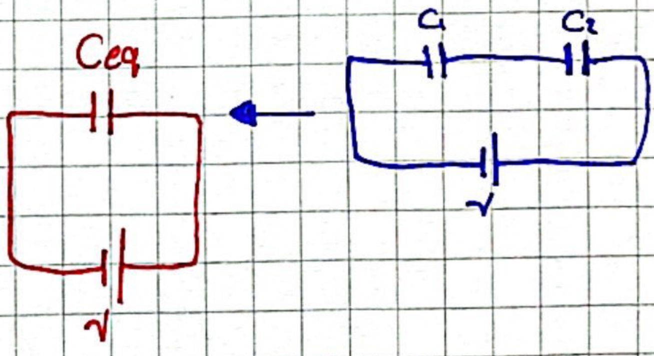
→ $C = \frac{Q}{V}$

## Part 1: Parallel




- $V_1 = V_2 = V_{eq}$
- $Q_1 + Q_2 = Q_{eq}$
- بالتالي → $C_{eq} = C_1 + C_2$

## Part 2: Series




- $V_1 + V_2 = V_{eq}$
- $Q_1 = Q_2 = Q_{eq}$
- بالتالي → $\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} = \frac{C_1 + C_2}{C_1 C_2}$

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