$\vec{r}_{P/O} = \vec{r}_{P/O'} + \vec{r}_{O'/O}$ CONDICIÓN DE EQUILIBRIO: $\Sigma F = 0$ $G = 6{,}673 \times 10^{-11} \frac{Nm^2}{kg^2}$

$\vec{v}_{P/O} = \vec{v}_{P/O'} + \vec{v}_{O'/O}$ MRUV: $x(t) = x_0 + v_0 t + \frac{1}{2} a t^2$

$\vec{a}_{P/O} = \vec{a}_{P/O'} + \vec{a}_{O'/O}$ $F_G = G \cdot \frac{m_1 \cdot m_2}{d^2}$ $F_e = -k\Delta x$ $[W] = J(\text{oule}) = Nm$

$J = \frac{kg\, m^2}{s^2}$

VELOCIDAD DE UN SISTEMA MASA - RESORTE: $|v| = \sqrt{v_0^2 - \frac{k}{m}(x^2 - x_0^2)}$

$\vec{x} \cdot \vec{y} = \sum_{i=1}^{m} x_i y_i = \|\vec{x}\| \|\vec{y}\| \cos(\theta)$, $\vec{X} \times \vec{Y} = (x_2 y_3 - x_3 y_2, x_3 y_2 - x_1 y_3, x_1 y_2 - x_2 y_1)$

MASA RESORTE $\begin{cases} \omega = 2\pi F = 2\pi / T \\ \omega = \sqrt{k/m}, \ T = 2\pi \sqrt{\frac{m}{k}} \end{cases}$ $= \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ x_1 & x_2 & x_3 \\ y_1 & y_2 & y_3 \end{vmatrix}$

Si la trayectoria es recta

PÉNDULO $\begin{cases} \omega = 2\pi T = \frac{2\pi}{F} = \sqrt{\frac{g}{L}} \\ T = 2\pi \sqrt{\frac{L}{g}} = m \cdot g \cdot \cos(\theta) + m \frac{v^2}{L} \end{cases}$ $W_F = \int_{r_1}^{r_2} \vec{F} \cdot d\vec{r} = F \cdot \Delta X$

$E_c = \frac{mv^2}{2} \Rightarrow \Delta E_c = \frac{m(v_f^2 - v_0^2)}{2}$ $\left.\begin{array}{l} E_{Pg(\text{gravitatoria})} = mgh \Rightarrow \Delta E_{Pg} = mg(h_f - h_0) \\ E_{PE(\text{elástica})} = \frac{kx^2}{2} \Rightarrow \Delta E_{PE} = \frac{k(x_f^2 - x_0^2)}{2} \end{array}\right\}$ CONSERVATIVAS.

$\Delta E_m = \Delta E_c + \Delta E_p$

$\vec{P} = m\vec{v}$, $\frac{d\vec{P}}{dt} = \vec{F}_{EXT} = M_{TOTAL} \vec{A}_{CM}$

$\Sigma F_{EXT.} = 0 \Rightarrow \frac{d\vec{P}}{dt} = 0 \Rightarrow \vec{V}_{CM} = CTE$, y $\left.\begin{cases} V_{CM} = CTE \\ v(0) = 0 \text{ (ARRANCA QUIETO EL SISTEMA)} \end{cases}\right\} \Rightarrow \vec{R}_{CM} = CTE$

$\vec{P}_{SISTEMA} = \vec{P}_{CM} = M_{TOTAL} \cdot \vec{V}_{CM}$ $\vec{R}_{CM} = \sum_{i=1}^{m} \frac{\vec{r}_i \cdot m_i}{M_{TOTAL}}$, $\vec{V}_{CM} = \sum_{i=1}^{m} \frac{\vec{v}_i \cdot m_i}{M_{TOTAL}}$

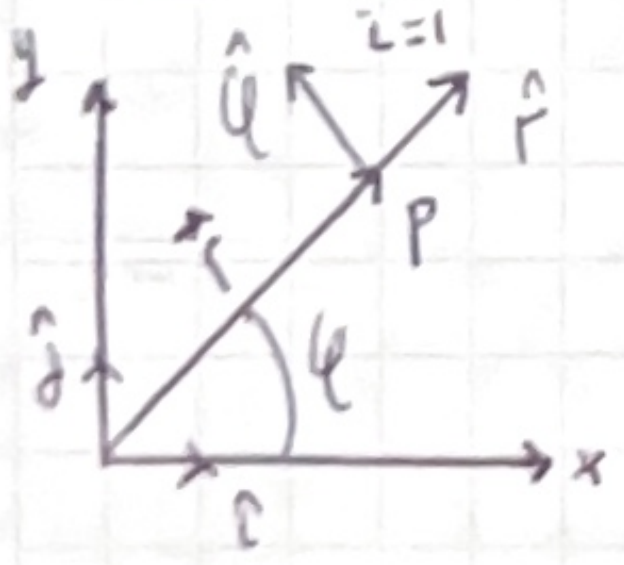
$E_{\text{SISTEMA DE PARTÍCULAS}} = \sum_{i=1}^{m} \frac{1}{2} m_i v_i^2$

$\Sigma F_{EXT} = 0 \Rightarrow \vec{P}_i = \vec{P}_f$, FUERZAS INTERNAS y SIN ROZAMIENTO $\Rightarrow \Delta E_{m_i} = \Delta E_{m_f} \Rightarrow E_{m_i} = E_{m_f}$

$-e = \frac{\vec{v}_2^f - \vec{v}_1^f}{\vec{v}_2^0 - \vec{v}_1^0}$ $e = 1 \rightarrow$ ELÁSTICO $0 < e < 1 \rightarrow$ INELÁSTICO/ENDOÉRGICO

$e = 0 \rightarrow$ PLÁSTICO $e > 1 \rightarrow$ Explosivo/EXOÉRGICO

$E_c = \sum_{i=1}^{m} E_{ci} = \sum_{i=1}^{m} \frac{1}{2} m_i \vec{v}_i^2 \Rightarrow E_{c/CM} = \sum_{i=1}^{m} \frac{1}{2} m_i \vec{v}_{i/CM}^2$ RESORTE SUELTA LAS MASAS $\Rightarrow$ $E_{c_f} = E_{p_i}$, $E_{p_f} = 0$



$P: \vec{r} = r\hat{r}$ $r = \sqrt{x^2 + y^2}$

$x = r\cos\varphi$ $\varphi = \text{ARCTAN}(y/x)$

$y = r\,\text{sen}\,\varphi$

$m(\text{mili}) = 10^{-3} = 0{,}001$

$\mu = 10^{-6}$

$\Delta E_{MEC}^{A \to B} = E_{MEC}(B) - E_{MEC}(A) = W_{F(NC)}^{A \to B}$

$n = 10^{-9}$

$E_{CIN} = \frac{1}{2} M_T V_{CM}^2 + E_{CIN/CM}$ } ESTO ES LA ENERGÍA CINÉTICA DE OTRO SISTEMA CON REFERENCIA AL CM

$p = 10^{-12}$

$f = 10^{-15}$

$\Delta E_m = W_{FNC}$. CONSERVATIVA $\Rightarrow$ W CONSTANTE INDEP DEL CAMINO.

$A_{ESF} = 4\pi r^2$

$V_{ESF} = \frac{4}{3}\pi r^3$

$$\vec{F}_{21} = \frac{k q_1 q_2 (\vec{r}_2 - \vec{r}_1)}{|\vec{r}_2 - \vec{r}_1|^3} \qquad \vec{F}_j = \sum_{\substack{i=1\\ j\neq i}}^{m} \frac{k q_j q_i (\vec{r}_j - \vec{r}_i)}{|\vec{r}_j - \vec{r}_i|^3}$$

Dipolo: $+q \quad -q$

$$K = 8{,}99 \cdot 10^9 \, N \frac{m^2}{C^2} \qquad k = \frac{1}{4\pi\varepsilon_0}$$

$[q] = C \quad [V] = Volt$

$[E] = \frac{N}{C} = \frac{Volt}{m}$ → útil para la carga entre placas

$[U] = J$

$[C] = F = \frac{[Q]}{[\Delta V]} = \frac{C}{V} = \frac{C}{\frac{C}{[\varepsilon_0] m}} = [\varepsilon_0] m$

$\Rightarrow [\varepsilon_0] = \frac{F}{m}$

$$\vec{F}_{q_0} = \frac{q_0}{4\pi\varepsilon_0} \int h(\vec{r}\,') \frac{\vec{r} - \vec{r}\,'}{|\vec{r} - \vec{r}\,'|^3} \, dl \; (\text{ó } ds \text{ ó } dv)$$

- q_0 está en $\vec{r}$
- $\vec{r}\,'$ es el genérico del cargado

$$h(\vec{r}\,') = \begin{cases} \lambda(\vec{r}\,') \leftarrow \lambda = dq/dl \\ \sigma(\vec{r}\,') \leftarrow \sigma = dq/ds \\ \rho(\vec{r}\,') \leftarrow \rho = dq/dv \end{cases}$$

$$Q = \lambda_0 L = \sigma_0 S = \rho_0 V \qquad \vec{E}(\vec{r}) = \frac{\vec{F}(\vec{r})}{q_0}$$

$$\vec{E}(\vec{r}) = k \sum_{i=1}^{m} \frac{q_i (\vec{r} - \vec{r}_i)}{|\vec{r} - \vec{r}_i|^3} = k \iiint \frac{\rho(\vec{r}\,')(\vec{r} - \vec{r}\,')}{|\vec{r} - \vec{r}\,'|^3} \, dr'^3 = -\vec{\nabla} V(\vec{r})$$

$\vec{E}(\vec{r}) = E(r)\hat{r}$

$d\vec{l} = dr\,\vec{r}$

$$V(\vec{r}) = k \sum_{i=1}^{m} \frac{q_i}{|\vec{r} - \vec{r}_i|} \qquad \Phi = \oiint_S \vec{E}\, d\vec{s} = \frac{Q_{ENC}}{\varepsilon_0} = \frac{\sum q \Leftrightarrow \exists (q \cap S)}{\varepsilon_0}$$

$$\Delta V = V(\vec{r}_f) - V(\vec{r}_i) = \frac{W_{i \to f}}{q_0} = -\int_i^f \vec{E}\, d\vec{l} \quad , \quad \vec{\nabla}\vec{E} = \frac{\rho}{\varepsilon_0} \quad , \quad \vec{E}_{\text{superficie de un conductor}} = \frac{\sigma}{\varepsilon_0}\vec{n}$$

$$\oiint_S d\vec{s} = sup(S)$$

→ Solo la sup EXTERNA del conductor redistribuye cargas.

→ CONDUCTOR EN EQUILIBRIO ⇒ CARGA NULA: $q_{int} = 0$

$\Delta V_{\text{dentro del conductor}} = 0$

$$C = \frac{\varepsilon_0 \varepsilon_r A}{d} \; (\varepsilon_r = 1 \text{ en el vacío}) \; , \; C = \frac{Q}{\Delta V} \; , \; \sigma = \frac{\varepsilon_0 V_0}{d} = \frac{Q}{A} \; , \; \varepsilon = \varepsilon_r \varepsilon_0$$

$$C_{//} = \sum_{i=1}^{m} C_i \; , \; \frac{1}{C_\Sigma} = \sum_{i=1}^{m} \frac{1}{C_i}$$

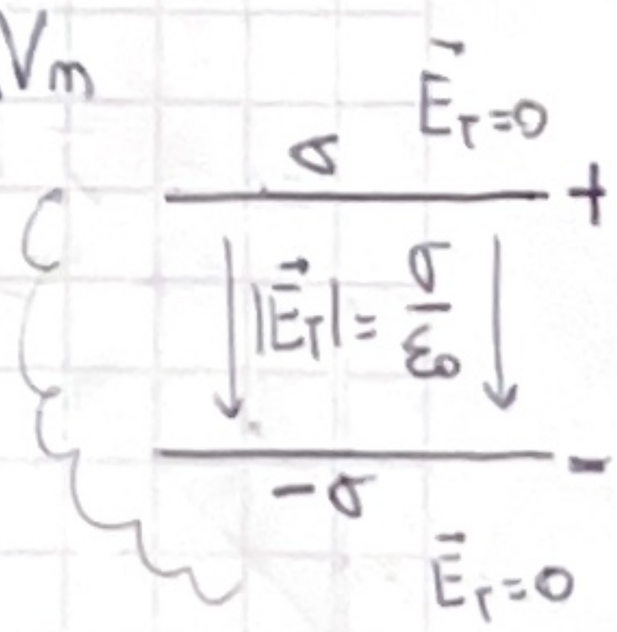
→ Los capacitores en paralelo comparten diferencia de voltaje

→ " " " serie " carga.

$Q = CV_0$

PARALELO
$$\begin{cases} \Delta V_1 = \Delta V_2 = \dots = \Delta V_T \\ Q_T = Q_1 + \dots + Q_m \end{cases}$$

SERIE
$$\begin{cases} Q_1 = Q_2 = \dots = Q_T \\ \Delta V_T = \Delta V_1 + \dots + \Delta V_m \end{cases}$$

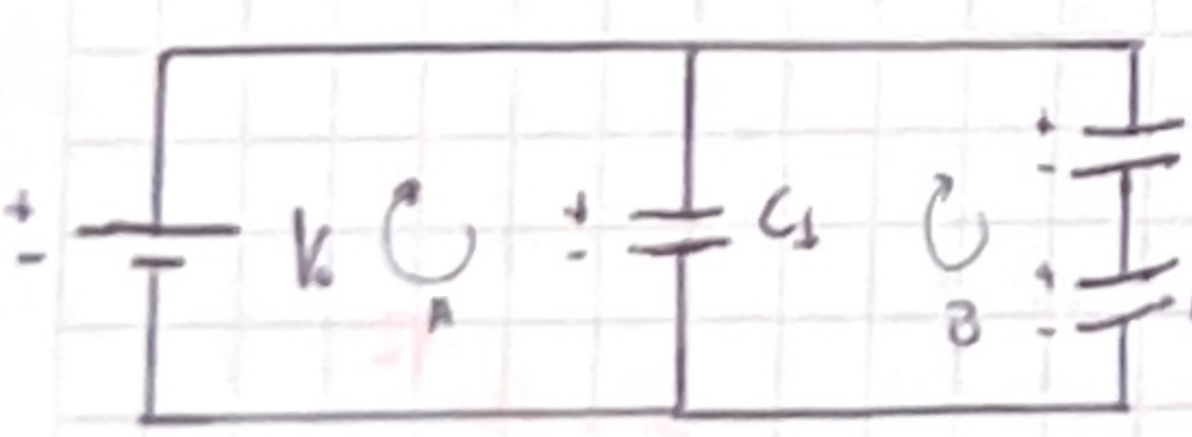


→ El dieléctrico baja la intensidad del campo $\vec{E}$ ⇒ baja ΔV ⇒ sube C

$q_{libres} = q_{libres} - q_{pol}$

E_1 | cond 1 | E_A | E_2 E_3 | cond 2 | E_B | E_4

$$\Rightarrow \begin{cases} \vec{E}_A = \frac{\vec{E}_1 - \vec{E}_2 - \vec{E}_3 - \vec{E}_4}{2\varepsilon_0} = 0 \\ \vec{E}_B = \frac{\vec{E}_1 + \vec{E}_2 + \vec{E}_3 - \vec{E}_4}{2\varepsilon_0} = 0 \end{cases}$$



MÉTODO DE ISLAS:

→ ISLA 1: $I_1 I_2 \Rightarrow +Q_1^i + Q_2^i = +Q_1^f + Q_2^f$

→ ISLA 2: $I_3^2 \Rightarrow -Q_2^i + Q_3^i = -Q_2^f + Q_3^f$

→ ISLA 3: $I_1 I^3 \Rightarrow -Q_3^i - Q_2^i = -Q_3^f - Q_2^f$

DEFINIMOS LAS 2 MALLAS (A y B) CON SUS ECUACIONES:
$$\begin{cases} \Delta V_0 = \Delta V_{C_1} \\ \Delta V_0 = \Delta V_{C_2} + \Delta V_{C_3} \end{cases}$$

$$U = \frac{1}{2} \sum_{i=1}^{N} q_i V(\vec{r}_i) = \frac{1}{2} \iiint_{VOL} \rho(\vec{r}\,') V(\vec{r}\,') \, dr'^3$$