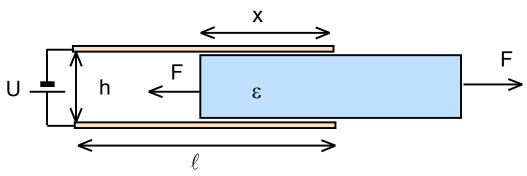


$$C=\frac{\varepsilon_0\ell^2}{h};\ \mathcal{E}=\frac{CU^2}{2}=\frac{\varepsilon_0\ell^2U^2}{2h}=\frac{\varepsilon_0U^2\ell^2h}{2h^2}=\frac{\varepsilon_0E^2V}{2}=PV\Rightarrow P=w=\frac{\varepsilon_0E^2}{2}$$

$$\mathcal{E}=\frac{q^2}{2C}=\frac{q^2}{\frac{2\varepsilon_0\ell^2}{h}}=\frac{q^2\ell^2h}{2\varepsilon_0\ell^4}=\frac{\sigma^2V}{2\varepsilon_0}=PV\Rightarrow P=w=\frac{\sigma^2}{2\varepsilon_0};\ \sigma=\frac{q}{\ell^2}$$

$$E=\frac{U}{h}=\frac{\frac{\varepsilon_0\ell^2}{h}U}{\varepsilon_0\ell^2}=\frac{CU}{\varepsilon_0\ell^2}=\frac{q}{\varepsilon_0\ell^2}=\frac{\sigma}{\varepsilon_0}$$

$$C=\frac{\varepsilon\varepsilon_0\ell^2}{h};\ \mathcal{E}=\frac{CU^2}{2}=\frac{\varepsilon\varepsilon_0\ell^2U^2}{2h}=\frac{\varepsilon\varepsilon_0U^2\ell^2h}{2h^2}=\frac{\varepsilon\varepsilon_0E^2V}{2}=PV\Rightarrow P=w=\frac{\varepsilon\varepsilon_0E^2}{2}$$

$$E=\frac{U}{h}=\frac{\frac{\varepsilon\varepsilon_0\ell^2}{h}U}{\varepsilon\varepsilon_0\ell^2}=\frac{CU}{\varepsilon_0\ell^2}=\frac{q}{\varepsilon\varepsilon_0\ell^2}=\frac{\sigma}{\varepsilon\varepsilon_0}$$

$$\mathcal{E}=\frac{q^2}{2C}=\frac{q^2}{\frac{2\varepsilon\varepsilon_0\ell^2}{h}}=\frac{q^2\ell^2h}{2\varepsilon\varepsilon_0\ell^4}=\frac{\sigma^2V}{2\varepsilon\varepsilon_0}=PV\Rightarrow P=w=\frac{\sigma^2}{2\varepsilon\varepsilon_0};\ \sigma=\frac{q}{\ell^2}$$

$$C_1=\frac{\varepsilon_0\ell(\ell-H)}{h};\ C_2=\frac{\varepsilon\varepsilon_0\ell H}{h}$$

$$q_1=C_1U=\frac{\varepsilon_0\ell(\ell-H)U}{h};\ q_2=C_2U=\frac{\varepsilon\varepsilon_0\ell HU}{h}$$

$$\sigma_1=\frac{q_1}{\ell(\ell-H)}=\frac{\varepsilon_0U}{h};\ \sigma_2=\frac{q_2}{\ell H}=\frac{\varepsilon\varepsilon_0U}{h}=\varepsilon\sigma_1$$

$$E_1=\frac{\sigma_1}{\varepsilon_0}=\frac{U}{h}=E;$$

$$E_2=\frac{\sigma_2}{\varepsilon\varepsilon_0}=\frac{\varepsilon\varepsilon_0U}{\varepsilon\varepsilon_0h}=\frac{U}{h}=E$$

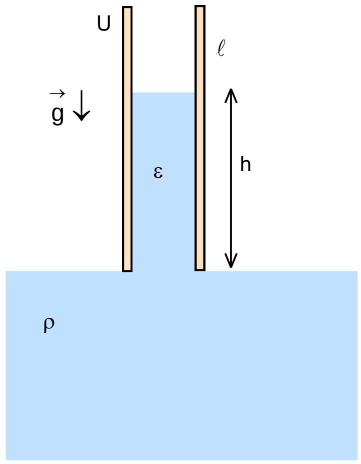
$$P_1=\frac{\varepsilon_0E_1{}^2}{2}=\frac{\varepsilon_0U^2}{2h^2};\ P_2=\frac{\varepsilon_0\varepsilon E_2{}^2}{2}=\frac{\varepsilon\varepsilon_0U^2}{2h^2}$$

$$P_2-P_1=\rho gH;\ \frac{\varepsilon\varepsilon_0U^2}{2h^2}-\frac{\varepsilon_0U^2}{2h^2}=\rho gH;\ U=\sqrt{\frac{2\rho gh^2}{\varepsilon_0(\varepsilon-1)}}$$

$$F=(P_0-P)\ell h=\left(\frac{\varepsilon_0E_0{}^2}{2}-\frac{\varepsilon_0E_0{}^2}{2\varepsilon}\right)\ell h=\frac{\varepsilon_0(\varepsilon-1)E_0{}^2}{2\varepsilon}\ell h=\frac{\varepsilon_0(\varepsilon-1)U^2}{2\varepsilon h^2}\ell h=\frac{\varepsilon_0(\varepsilon-1)\ell U^2}{2\varepsilon h}$$

$$C=\frac{\varepsilon_0\ell(\ell-x)}{h}+\frac{\varepsilon\varepsilon_0\ell x}{h}\qquad \mathcal{E}_p=\frac{CU^2}{2}=\left[\frac{\varepsilon_0\ell(\ell-x)}{h}+\frac{\varepsilon\varepsilon_0\ell x}{h}\right]\frac{U^2}{2}$$

$$F=-\frac{d\mathcal{E}_p}{dx}=-\left[-\frac{\varepsilon_0\ell}{h}+\frac{\varepsilon\varepsilon_0\ell}{h}\right]\frac{U^2}{2}=\frac{\varepsilon_0(\varepsilon-1)\ell U^2}{2h}$$



$$F=(P_0-P)\ell h=\left(\frac{\varepsilon_0 E_0^{\,2}}{2}-\frac{\varepsilon_0 E_0^{\,2}}{2\varepsilon}\right)\ell h=\frac{\varepsilon_0(\varepsilon-1)E_0^{\,2}}{2\varepsilon}\,\ell h=\frac{\varepsilon_0(\varepsilon-1)U^2}{2\varepsilon h^2}\,\ell h=\frac{\varepsilon_0(\varepsilon-1)\ell U^2}{2\varepsilon h}$$

$$\mathcal{E}_p=\frac{CU^2}{2}=\left[\frac{\varepsilon_0\ell(\ell-h)}{h}+\frac{\varepsilon\varepsilon_0\ell h}{h}\right]\frac{U^2}{2}$$

$$F=-\frac{d\mathcal{E}_p}{dh}=-\left[-\frac{\varepsilon_0\ell}{h}+\frac{\varepsilon\varepsilon_0\ell}{h}\right]\frac{U^2}{2}=\frac{\varepsilon_0(\varepsilon-1)\ell U^2}{2h}$$

$q=CU$

$W=qU=CU^2$

$\Pi=\frac{CU^2}{2}=Q$

$$P-P_0=\frac{\varepsilon\varepsilon_0 U^2}{2h^2}-\frac{\varepsilon_0 E_0^{\,2}}{2}=\rho g h$$

$$U=\frac{q}{C}+IR=\frac{q}{C}+\frac{dq}{dt}R\Rightarrow\frac{dq}{dt}R=U-\frac{q}{C}=\frac{UC-q}{C}\Rightarrow\frac{dq}{UC-q}=\frac{dt}{RC}\Rightarrow-\frac{d(UC-q)}{UC-q}=\frac{dt}{RC}\Rightarrow\frac{d(UC-q)}{UC-q}=-\frac{dt}{RC}$$

$$\int_0^q\frac{d(UC-q)}{UC-q}=-\int_0^t\frac{dt}{RC}\Rightarrow\ln(UC-q)\Big|_0^q=-\frac{t}{RC}\Rightarrow\ln\frac{UC-q}{UC}=-\frac{t}{RC}\Rightarrow\frac{UC-q}{UC}=e^{-\frac{t}{RC}}\Rightarrow UC-q=UCe^{-\frac{t}{RC}}$$

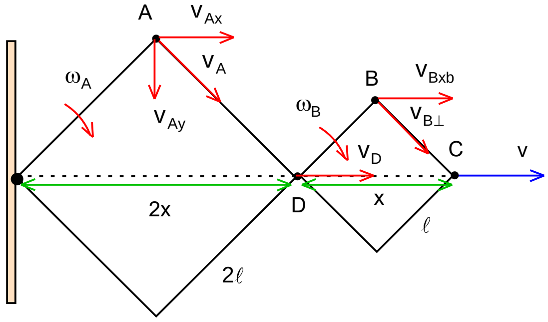
$$q=UC\left(1-e^{-\frac{t}{RC}}\right)\Rightarrow I=\frac{dq}{dt}=-UC\frac{1}{RC}e^{-\frac{t}{RC}}=-\frac{Ue^{-\frac{t}{RC}}}{R}$$

$$P=I^2R=\frac{U^2e^{-\frac{2t}{RC}}}{R}\Rightarrow Q=\int_0^\infty Pdt=\int_0^\infty\frac{U^2e^{-\frac{2t}{RC}}}{R}dt=-\frac{RC}{2}\int_0^\infty\frac{U^2e^{-\frac{2t}{RC}}}{R}d\left(\frac{2t}{RC}\right)=-\frac{C}{2}\int_0^\infty U^2e^{-x}dx=\frac{CU^2}{2}\left(-e^{-x}\right)\Big|_0^\infty=\frac{CU^2}{2}\left(-\frac{1}{\infty}-(-1)\right)=\frac{CU^2}{2}$$

$$\Pi=\frac{CU^2}{2}=\frac{\varepsilon_0\ell^2U^2}{2h}=\frac{\varepsilon_0U^2\ell^2h}{2h^2}=\frac{\varepsilon_0E^2V}{2}=PV\Rightarrow P=w=\frac{\varepsilon_0E^2}{2}$$

$$E_+=E_-=\frac{\sigma}{2\varepsilon_0}\qquad E=2E_-=2E_+=\frac{\sigma}{\varepsilon_0}\qquad U=Eh=\frac{\sigma h}{\varepsilon_0}=\frac{qh}{\varepsilon_0 S}=\frac{q}{\frac{\varepsilon_0 S}{h}}=\frac{q}{C}\ ;\ C=\frac{\varepsilon_0 S}{h}$$

$$F=qE_+=CU.\frac{\sigma}{2\varepsilon_0}=\frac{\varepsilon_0 SU}{h}\frac{\sigma}{2\varepsilon_0}=\frac{\varepsilon_0 SU}{h}\frac{q}{2S\varepsilon_0}=\frac{\varepsilon_0 SU}{h}\frac{1}{2S\varepsilon_0}\frac{\varepsilon_0 SU}{h}=\frac{\varepsilon_0U^2S}{2h^2}=\frac{\varepsilon_0E^2S}{2}=PS;\ P=\frac{\varepsilon_0E^2}{2}$$



$$v=\frac{3x}{t}\qquad v_D=\frac{2x}{t}=\frac{2v}{3}\qquad v_{AX}=\frac{x}{t}=\frac{v}{3}\qquad v_{BX}=\frac{5x}{2t}=\frac{5}{2}\frac{v}{3}=\frac{5v}{6}\qquad v_{BXb}=v_{BX}-v_D=\frac{5v}{6}-\frac{2v}{3}=\frac{v}{6}$$

$$v_{AX}=v_A\cos 45^o\Rightarrow\frac{v}{3}=v_A\frac{\sqrt{2}}{2}\Rightarrow v_A=\frac{\sqrt{2}v}{3}$$

$$v_{BXb}=v_{B\perp}\cos 45^o\Rightarrow\frac{v}{6}=v_{B\perp}\frac{\sqrt{2}}{2}\Rightarrow v_{B\perp}=\frac{\sqrt{2}v}{6}$$

$$v_B=\sqrt{v_{Bx}{}^2+\left(v_{B\perp}\sin 45^o\right)^2}=\sqrt{\left(\frac{5v}{6}\right)^2+\left(\frac{v\sqrt{2}}{6}\frac{\sqrt{2}}{2}\right)^2}=v\sqrt{\frac{25}{36}+\frac{1}{36}}=\frac{v\sqrt{26}}{6}$$

$$\frac{\sqrt{26}}{2\sqrt{2}}=\frac{\sqrt{13}}{2}$$