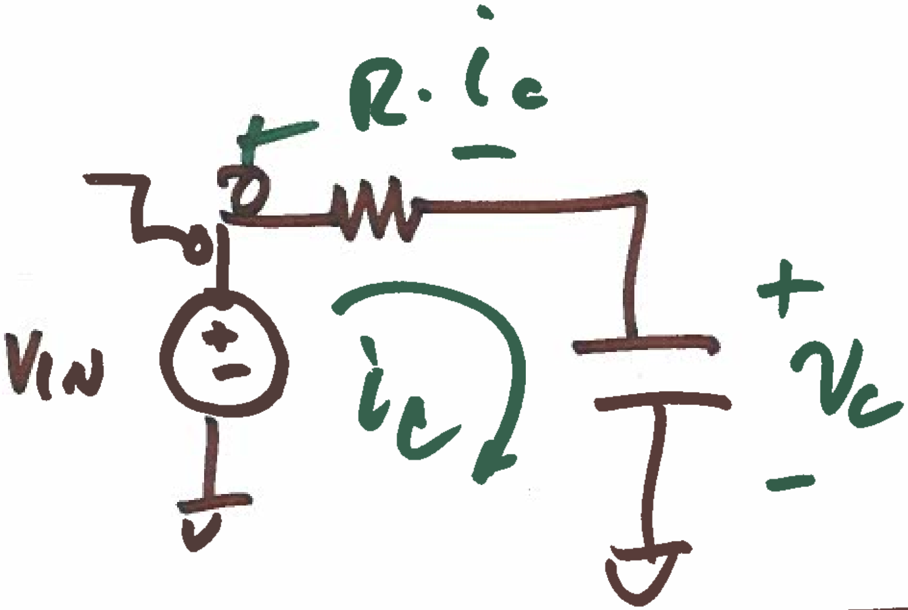
EE 220 Circuits 1

Nov. 4, 2019

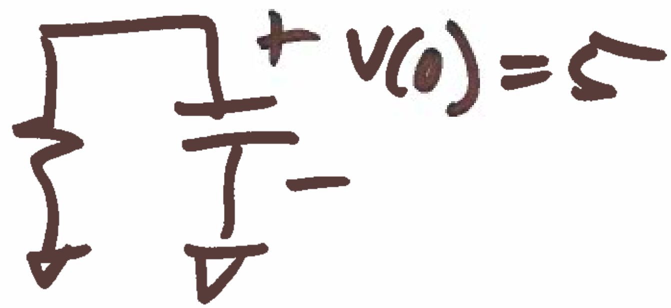
Lecture 19

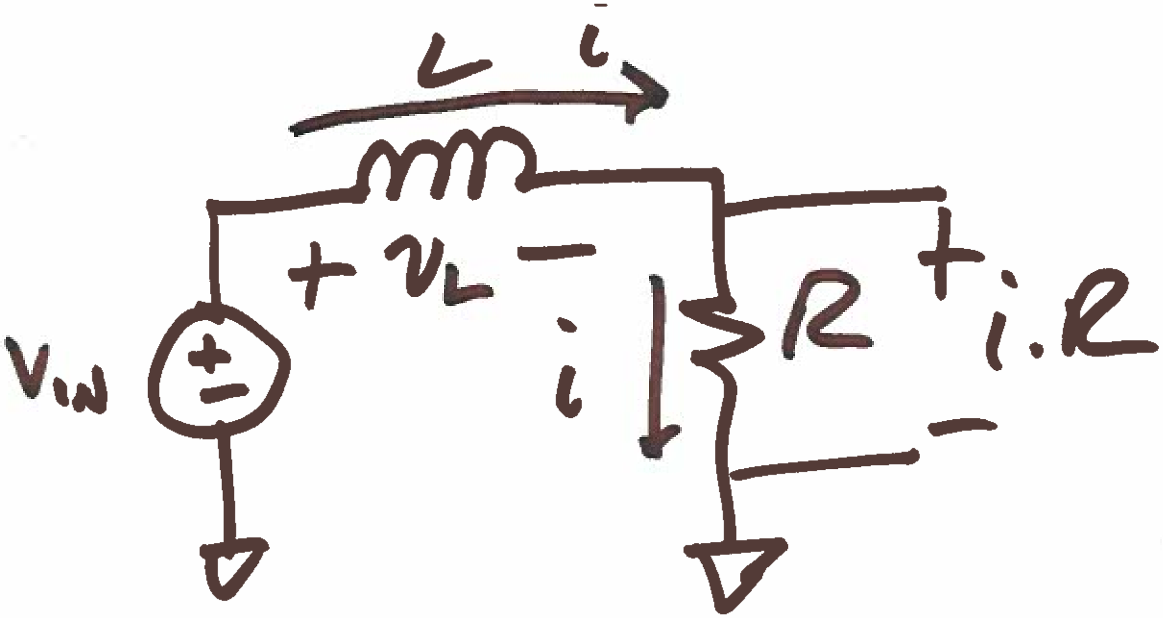


$$V_{IN} = i_c \cdot R + v_c$$

$$V_{IN} = RC \cdot \frac{dv_c}{dt} + v_c$$

$$i_c = C\frac{dv_c}{dt}$$



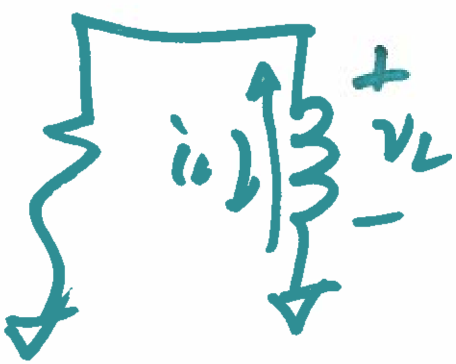


$$v_L = L\cdot\frac{di}{dt}$$

$$V_{IN} = V_L + i\cdot R$$

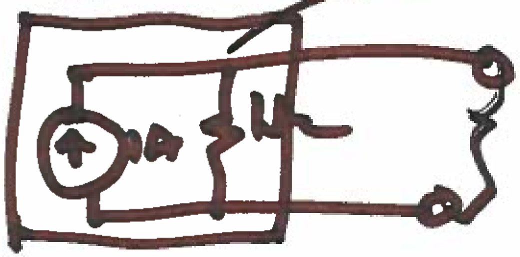
$$V_{in} = L\cdot\frac{di}{dt} + i\cdot R$$

$$\frac{V_{IN}}{R} = \frac{L}{R}\frac{di}{dt} + i$$



Resistors dissapating

NORTONS



$$P = I^2 \cdot R = VI = \frac{V^2}{R}$$

thevenin

Inductors & capacitors store energy

$$E = \int_{t_1}^{t_2} v_L(t) \cdot i(t)\, dt$$

$$v_L(t) = L \cdot \frac{di(t)}{dt}$$

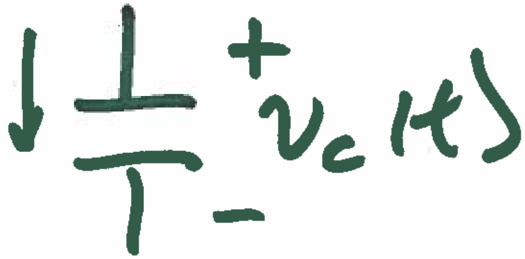
$$dt = L \cdot \frac{di(t)}{v_L(t)}$$

$$E = \int_{i(t_1)}^{i(t_2)} \cancel{v_L(t)} \cdot [redacted] i(t) \cdot L \cdot \frac{di(t)}{\cancel{v_L(t)}}$$

$$= L \int_0^I i \cdot di = \frac{1}{2} L \cdot I \Big|_0^I$$

$$\boxed{E = \frac{1}{2} L I^2}$$

I = change in current



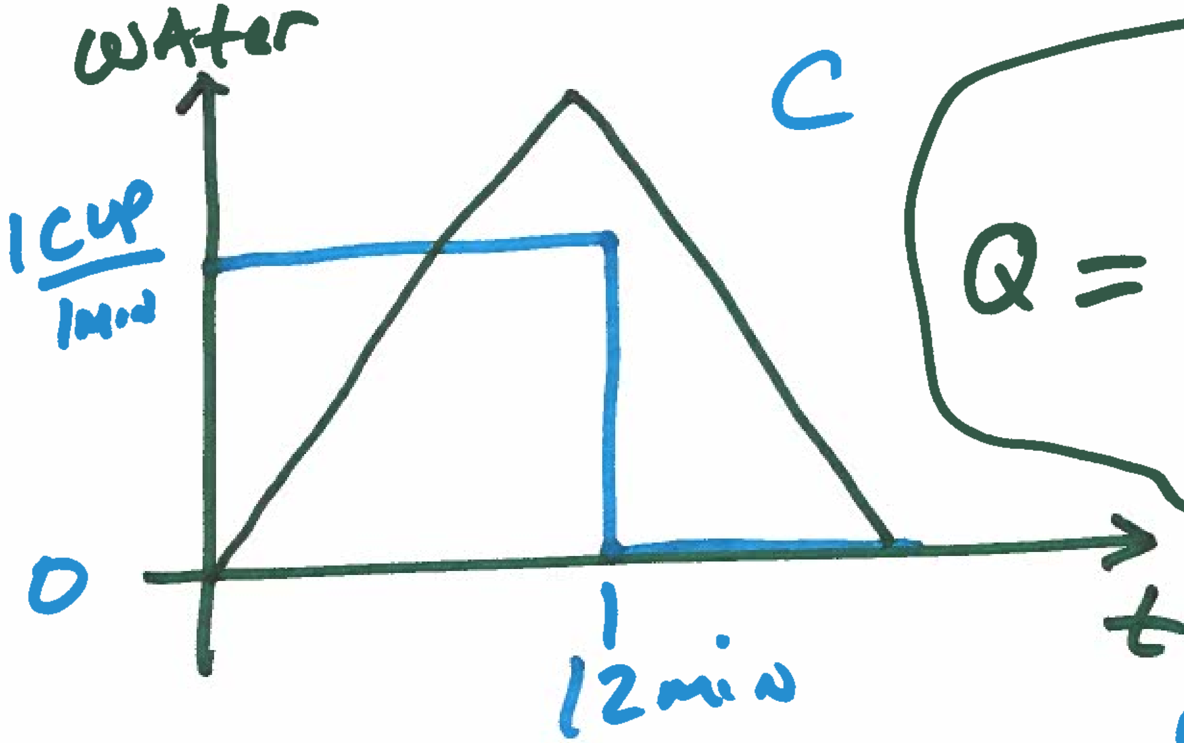
$$CV = Q$$

$$E = \int_0^Q v_c(t) \cdot dq$$

$$= \int_0^Q \frac{q(t)}{C} \cdot dq = \frac{1}{2}\frac{Q^2}{C}$$

$$\boxed{E = \frac{1}{2} C V^2}$$

C

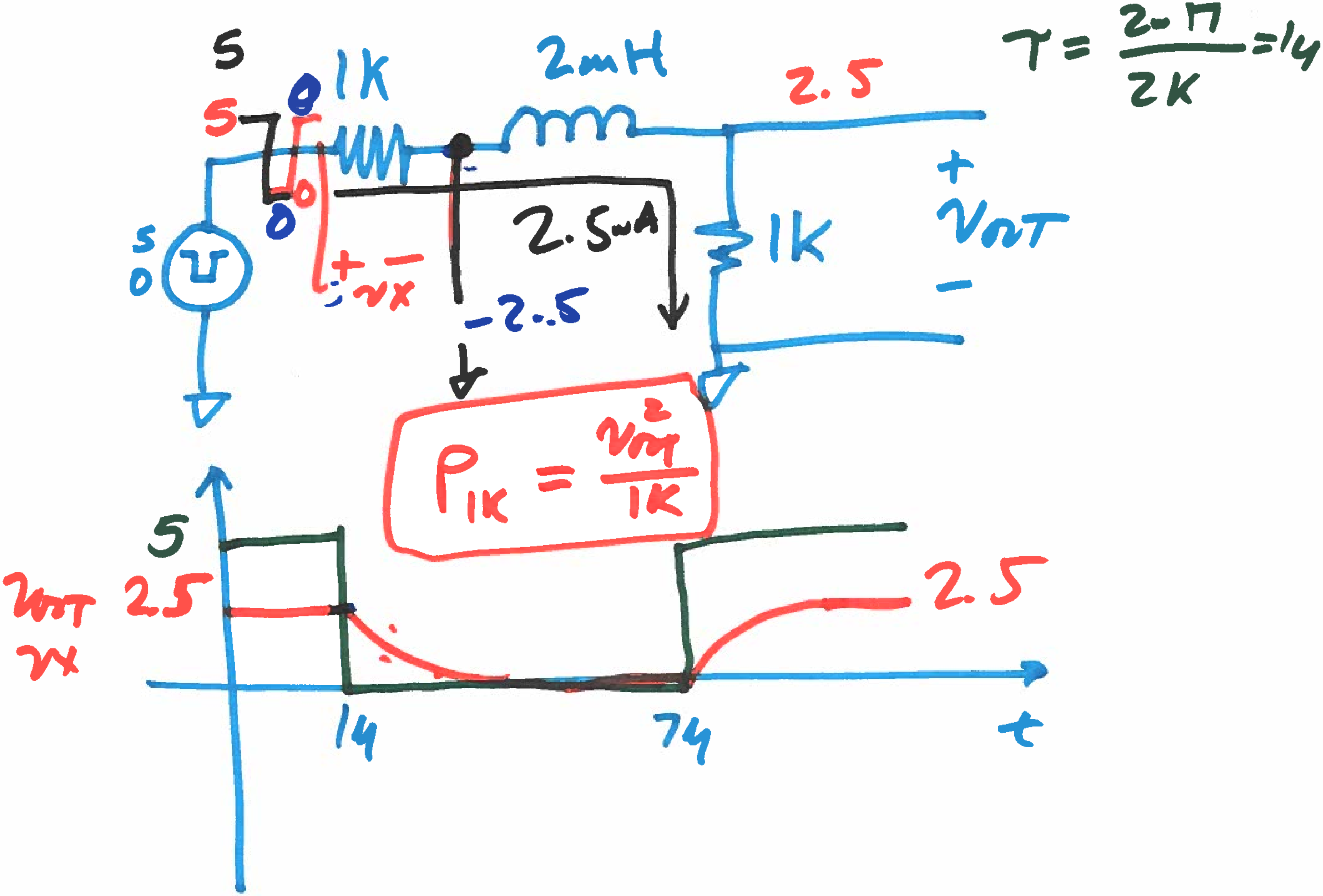


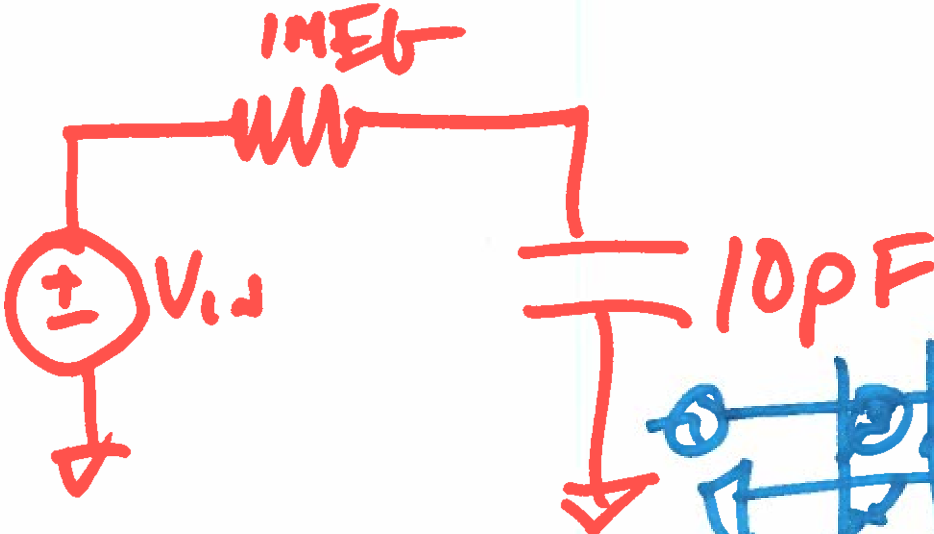
$$Q = \int_{t_1}^{t_2} i(t) \cdot dt$$

$$\text{Amount of water} = \int_0^{12\,\text{min}} \frac{1\,\text{cup}}{\text{min}} \cdot dt$$

$$= \frac{1\,\text{cup}}{\text{min}} \cdot 12\,\text{min}$$

$$= 12\,\text{cups}$$

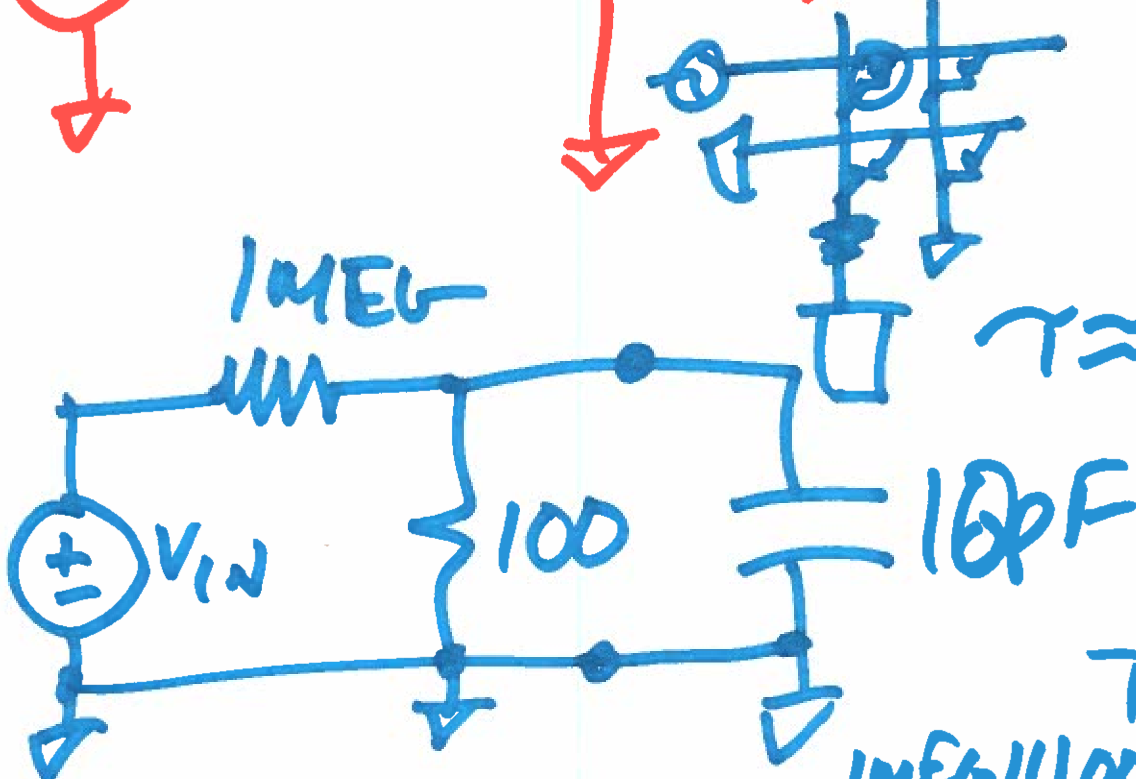

5
1K
2mH
2.5
$\tau = \frac{2m}{2K} = 1\mu$
2.5mA
1K
$+ v_{OUT} -$
$+ v_X -$
-2.5
$P_{1K} = \frac{v_{OUT}^2}{1K}$
5
v_{OUT} 2.5
v_X
2.5
1μ
7μ
t



$\tau = RC$

$= 10^{6} \cdot 10 \cdot 10^{-12}$

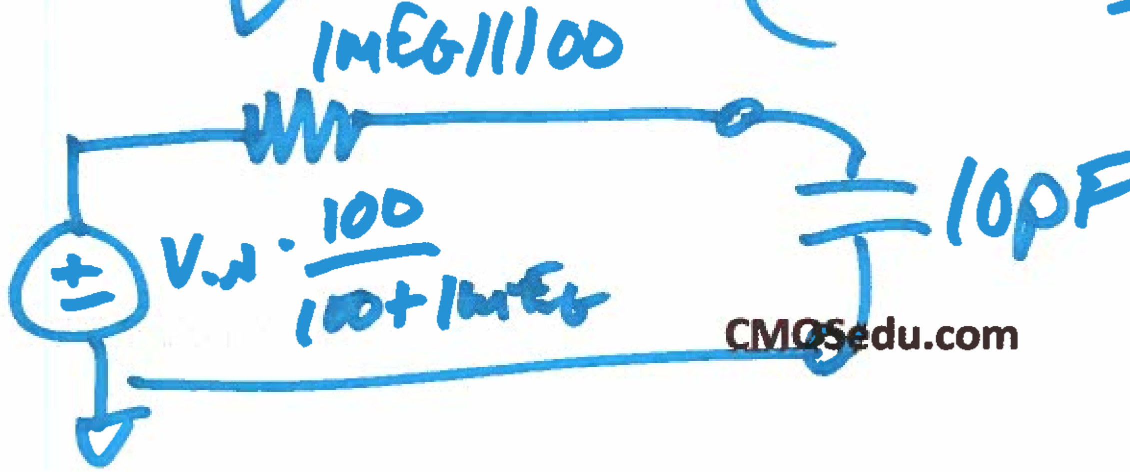
$= 10\,\mu s$

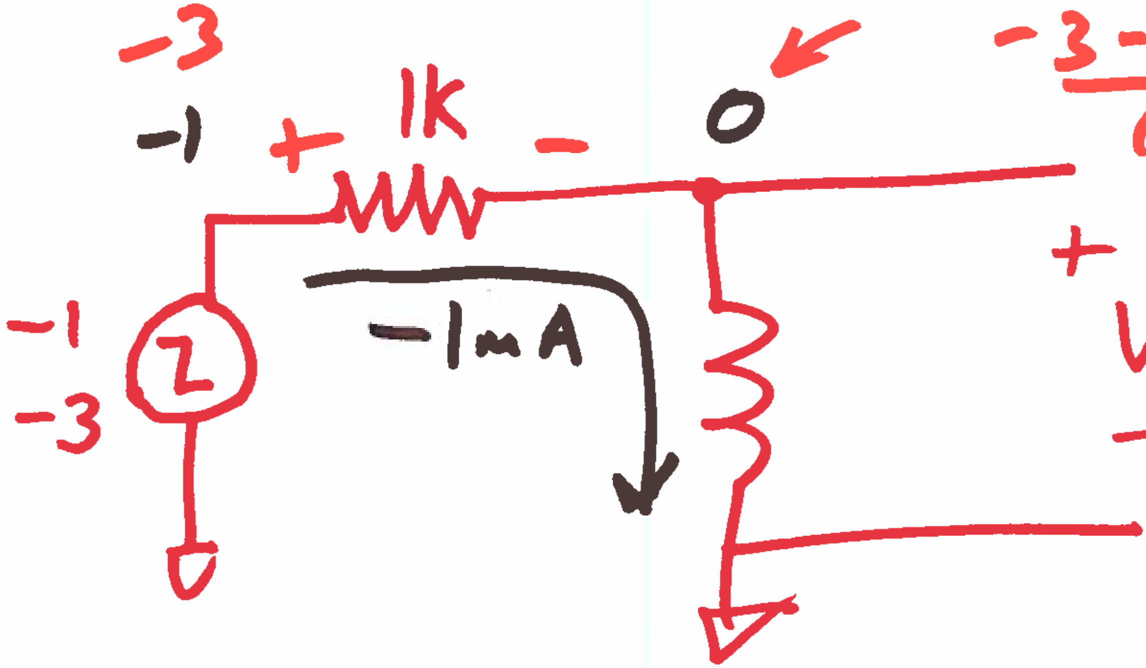


$\tau \simeq 100 \cdot 10 \cdot 10^{-12}$

$= \underline{1\,nS}$

$\tau \stackrel{?}{=} (1MEG + 100)C$

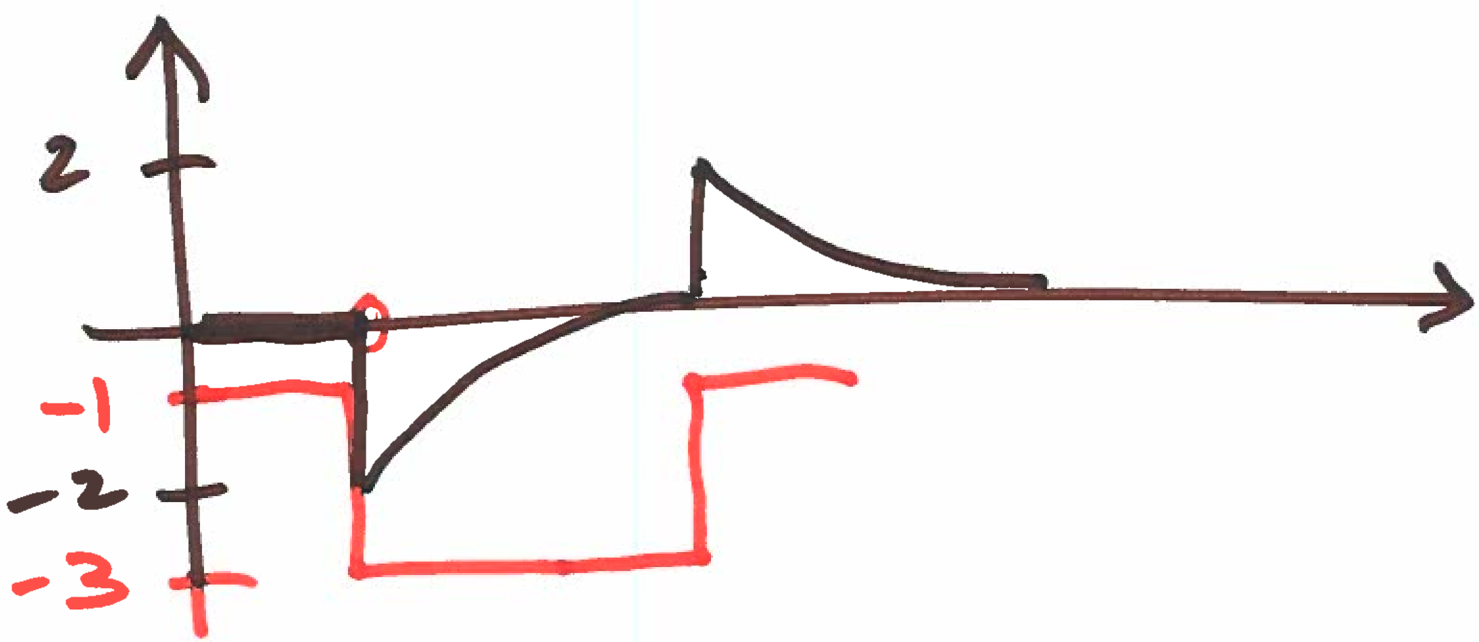




$$\frac{-3-V_{OUT}}{1k} = -1mA$$

$$-V_{OUT} = 2V$$

$$V_{OUT} = -2V$$



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