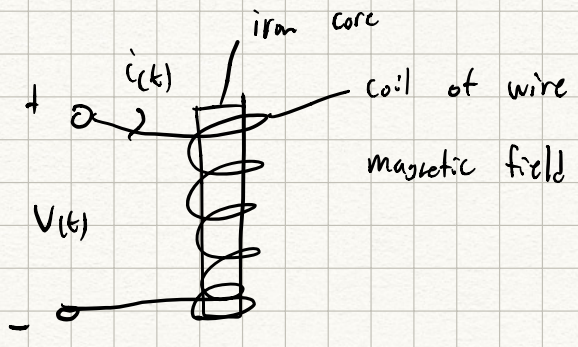
INDUCTORS



ideal inductor:

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

inductance units: $\frac{V \cdot s}{A}$

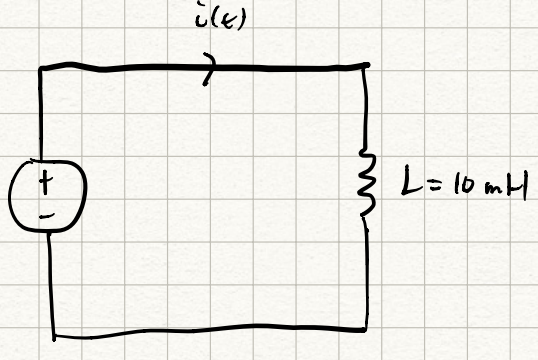
→ 1 Henry (H)

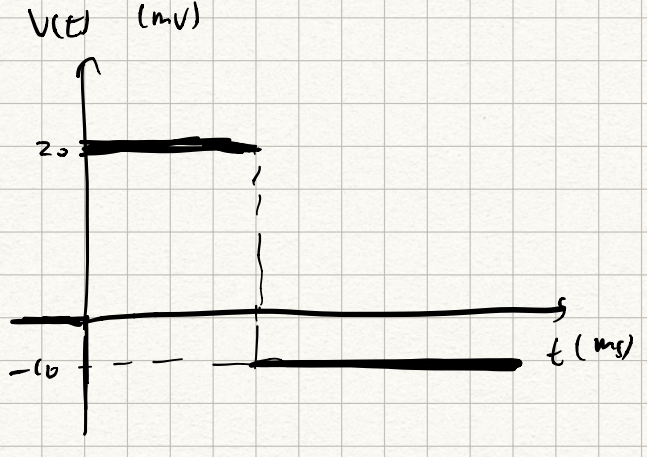
capacitor		inductor
i	→	V
V	→	i
C	→	L

$$i(t) = i(t_0) + \frac{1}{L}\int_{t_0}^{t} v(x)\,dx$$

$$W = w(t_2) - w(t_1) = \frac{1}{2}L\left[i^2(t_2) - i^2(t_1)\right]$$

Ex.





Find $i(t)$ assuming $i(0^-) = 0$

$0 \le t < 2$ ms:

$t_0 = 0$, $i(t_0) = i(0) = i(0^-) = 0$

$$i(t) = 0 + \frac{1}{10 \times 10^{-3}}\int_0^t 20 \times 10^{-3}\,dx$$

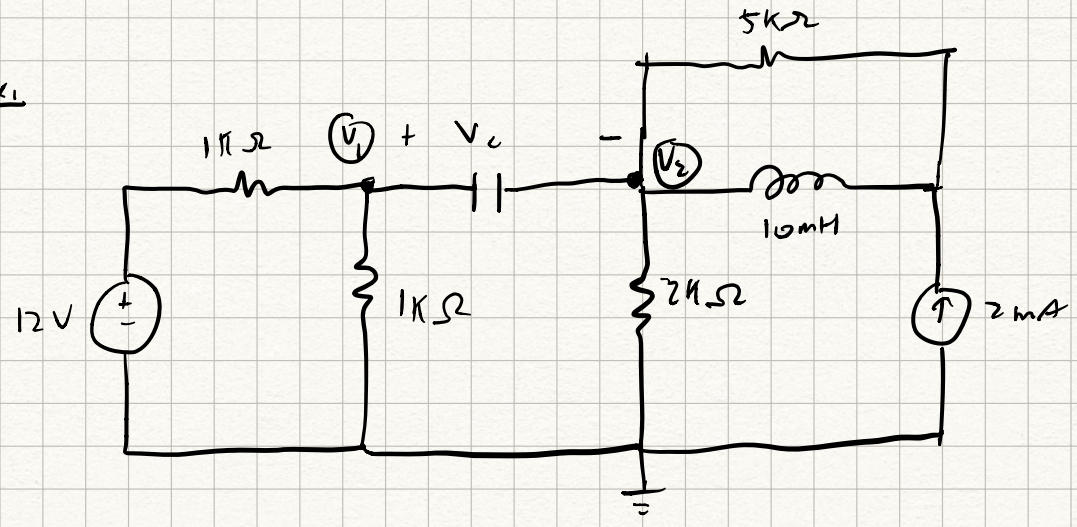
$$= 2t$$

$t \ge 2$:

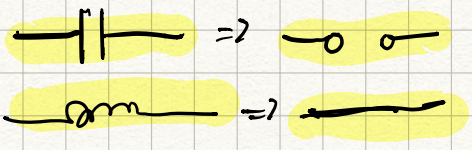
$t_0 = 2$ ms

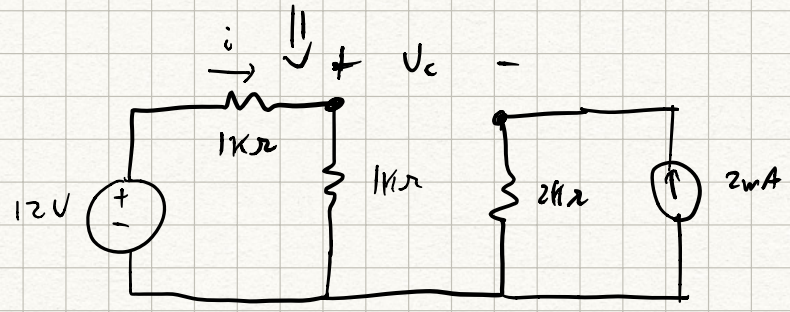
$$i(t_0) = i(2) = i(2^-) = 2(2 \times 10^{-3}) = 4 \times 10^{-3}$$

Ex1



find i and V_c





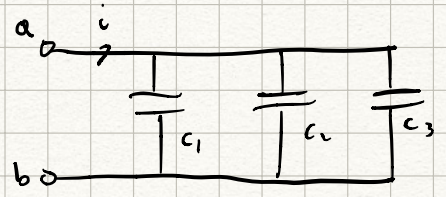
$$i = \frac{12}{1+1} = 6\ mA$$

$$V_c = V_1 - V_2 = 1(6) - 2(2)$$
$$= 2\ V$$

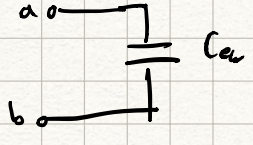
$$W_c = \frac{1}{2} C V_c^2$$
$$= \frac{1}{2}(5\times10^{-6})(2)^2$$

$$W_L = \frac{1}{2} L i^2 = \frac{1}{2}(10\times10^{-3})(2\times10^{-3})^2$$

$$= 20\ nJ$$



$\Rightarrow$

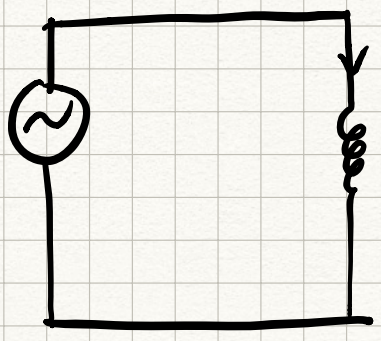


$$i = C_{eq}\frac{dv}{dt}$$

$$C_{eq} = C_1 + C_2 + C_3$$

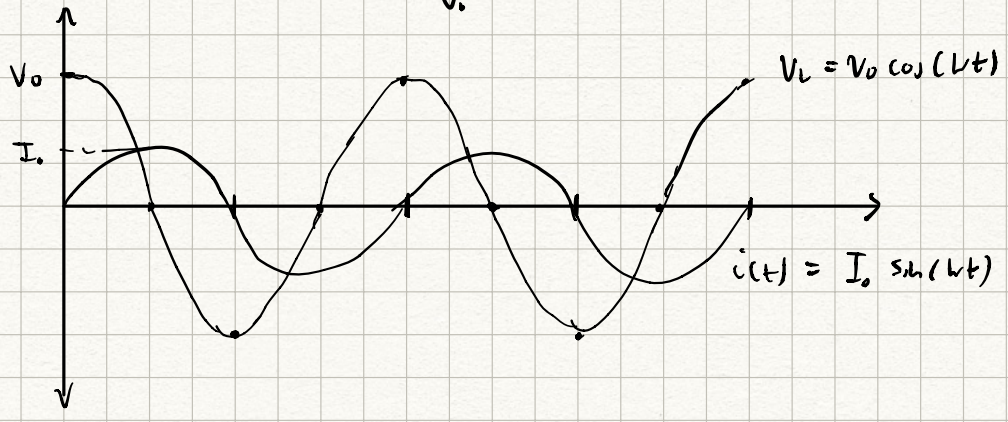
$$i = i_1 + i_2 + i_3$$
$$= C_1\frac{dv}{dt} + C_2\frac{dv}{dt} + C_3\frac{dv}{dt}$$
$$= (C_1 + C_2 + C_3)\frac{dv}{dt}$$

INDUCTORS IN AC



$$i(t) = I_0 \sin(\omega t)$$

$$V_L(t) = L \frac{di}{dt} = \underbrace{L I_0 \omega}_{V_0} \cos(\omega t)$$



Voltage leads by $\pi/2$

since $V_0 = L I_0 \omega$

$$V_0 = \underbrace{(L\omega)}_{} I_0$$

X_L = inductive reactance (Ω)

when $\omega \uparrow$, open circuit; $\omega \downarrow \Rightarrow$ short circuit