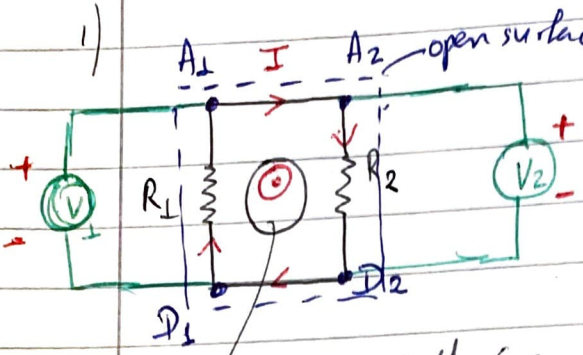
Kirchhoff's Loop Rule ~ Is for the Birds

1)



→ (open & closing switch)

↓ Magnetic Field (Electromagnet)

$\Phi = \int_{\text{open surface}} \vec{B} \cdot d\vec{s}$

$\oint \vec{E} \cdot d\vec{l} = 0$ ~ Kirchoff's

BUT

changing magnetic flux

$\therefore \oint \vec{E} \cdot d\vec{l} = -\frac{d\Phi_B}{dt} = EMF$

$EMF = I(R_1 + R_2)$

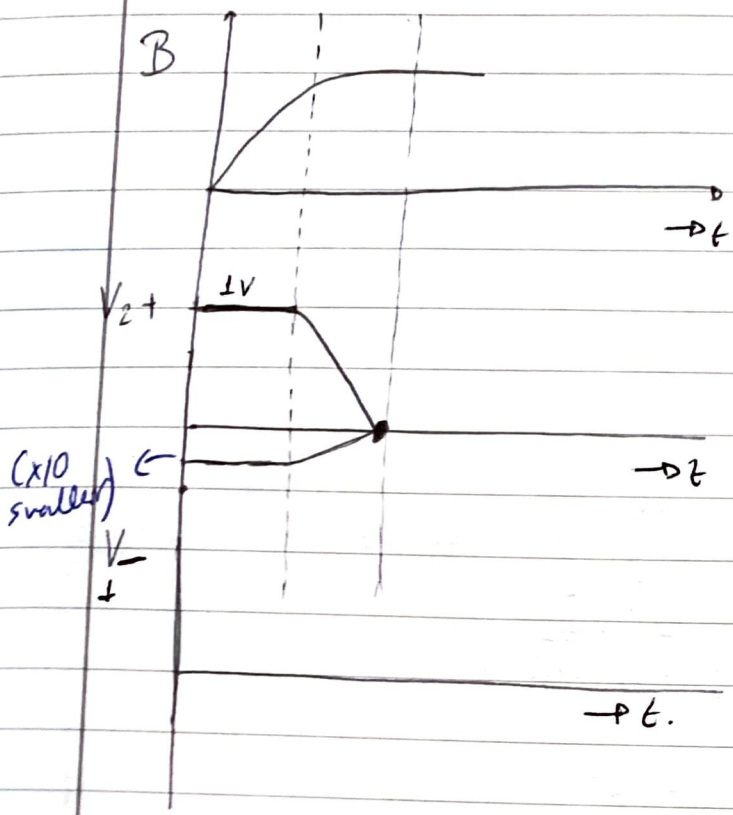
- $V_{A_2} - V_{D_2} = V_A - V_D = IR_2$ (V_2)

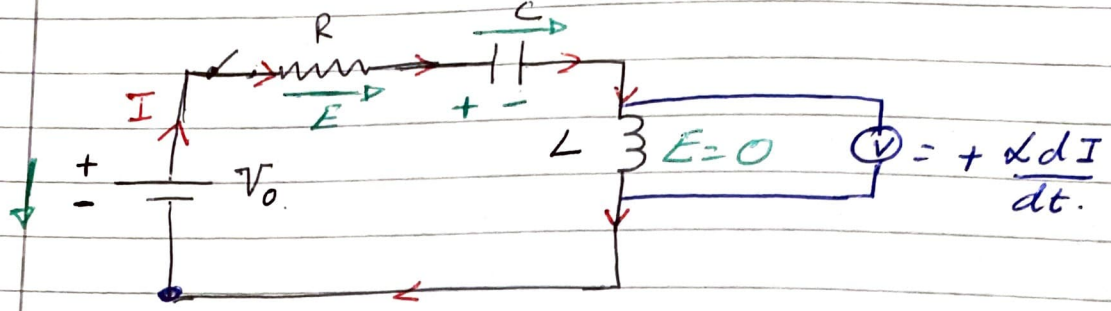
- $V_{A_1} - V_{D_1} = V_A - V_D = -IR_1$ (V_1)

- $\frac{V_2}{V_1} = -\frac{R_2}{R_1}$

(eg) $R_1 = 10\Omega$; $R_2 = 100\Omega$
$I = 10mA$.

$V_1 = -(10mA)(10\Omega) = -0.1V$
$V_2 = (100\Omega)(10mA) = +1V$


B
t
1V
V_2 +
(x10 smaller)
V_-
t.



$$\oint \vec{E} \cdot d\vec{l} = -\frac{d\Phi_B}{dt} \qquad C = \frac{Q}{V_C}$$

- $\underbrace{-V_0 + IR + \frac{Q}{V_C}}_{\text{closed loop integral}} = -L\frac{dI}{dt}$ ⇝ Faraday's Law

⇝ Kirchoff's ⇝ $-V_0 + IR + \frac{Q}{C} + \underbrace{L\frac{dI}{dt}}_{\text{Voltmeter}} = 0$