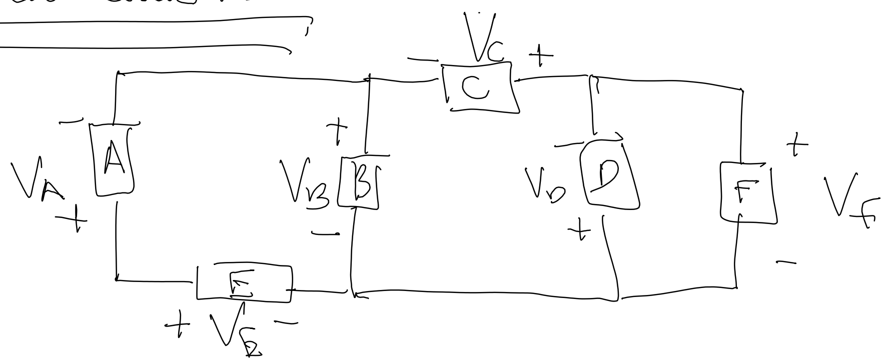
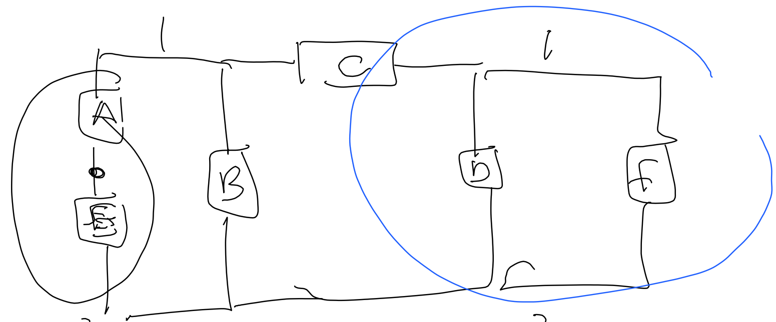
Discussion 1B (Week1)

Thursday, April 1, 2021 8:52 AM

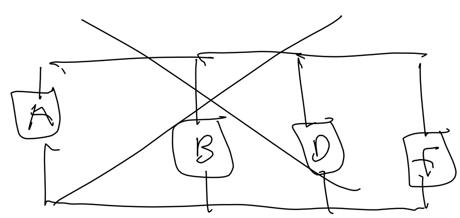
Review Quiz #2:



1.)



D & F are in parallel

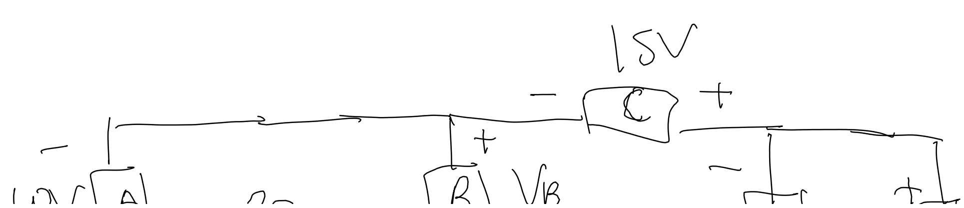


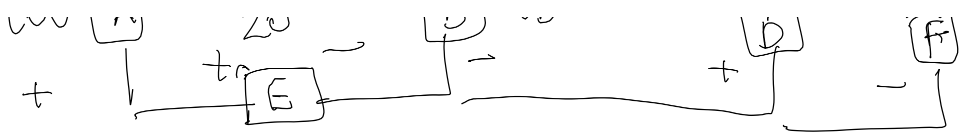
2) A & E are in series

3.) Relationship between D & F

$$V_D = -V_F$$

4.) $V_A = 10V$, $V_C = 15V$, $V_E = 20V$





① $V_A + V_B - V_E = 0$

$$V_B = V_E - V_A = 20 - 10 = \boxed{10V}$$

$$V_F = -V_D$$

② $V_B + V_C + V_D = 0$

$$10V + 15V + V_D = 0 \rightarrow V_D = -25V$$

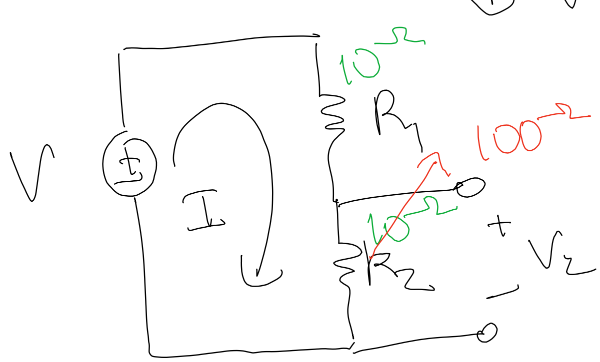
$$\boxed{V_F = 25V}$$

Theory

① Voltage Divider

① $V = IR_1 + IR_2$

$V_2 = IR_2$



$$V \quad \frac{R_2}{\quad} \quad V$$

$$\therefore \boxed{V_2 = \frac{\quad}{R_1+R_2} V}$$

$$V = I(R_1+R_2) \qquad V_2 = IR_2$$

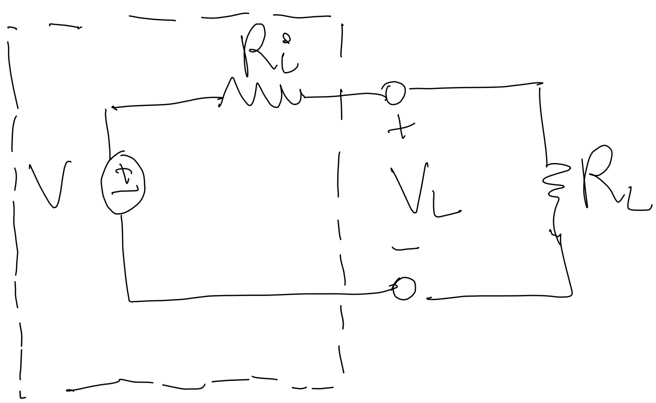
$$I = \frac{V}{R_1+R_2} \qquad I = \frac{V_2}{R_2}$$

$$\frac{V}{R_1+R_2} = \frac{V_2}{R_2}$$

$$V_2 = \frac{10}{10+10} V = \frac{1}{2} V$$

$$V_2 = \frac{100}{10+100} V = \frac{10}{11} V$$

→ non-ideal battery

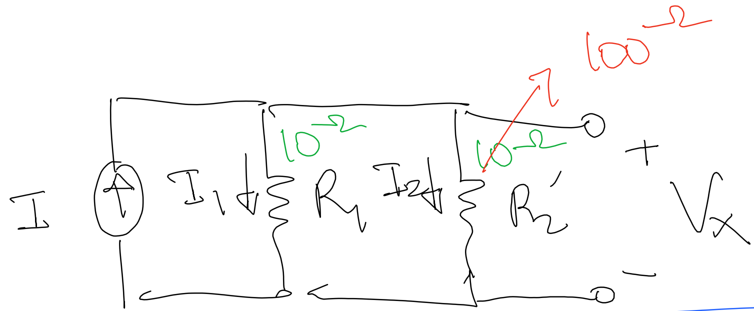


$$V_L = \frac{R_L}{R_L+R_i} V$$

If $R_i \to \infty$:

$$V_L \to 0$$

② Current Divider



$$\boxed{I_1 = \frac{R_2}{R_1+R_2} I \qquad I_2 = \frac{R_1}{R_1+R_2} I}$$

$$I = I_1 + I_2$$

$$V_x = I_1 R_1 = I_2 R_2$$

I_1 : ① $I_1 = I - I_2$ ② $I_2 = I_1 \frac{R_1}{R_2}$

$$I_1 = I - \left(I_1 \frac{R_1}{R_2} \right)$$

$$I_1 \left(1 + \frac{R_1}{R_2} \right) = I$$

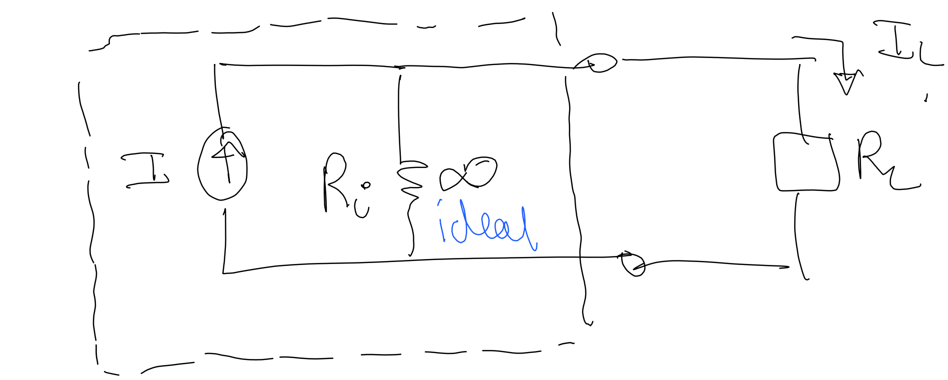
$$\therefore \boxed{I_1 = \left(\frac{R_2}{R_1+R_2} \right) I}$$

$$I_1 = \frac{10}{10+10} I = \frac{1}{2} I$$

$$I_1 = \frac{100}{10+100} I = \frac{10}{11} I$$

Why? sometimes its easier to solve for a current in terms of an[…] current (solve for I_1 in terms o[…]

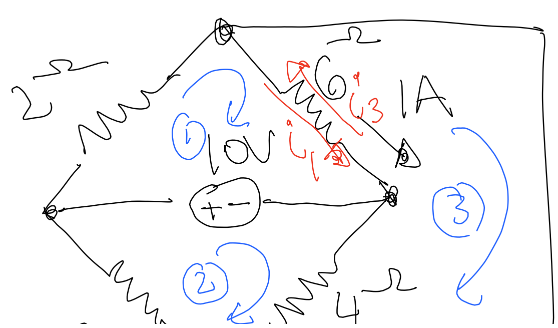
⇒ current source:



$$I_L = \frac{R_i^{\nearrow\infty}}{R_i^{\nearrow\infty} + R_L} I \rightarrow I_L \approx$$

Problem 1

$1A = i_1 - i_3$

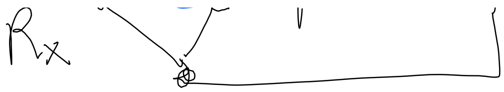


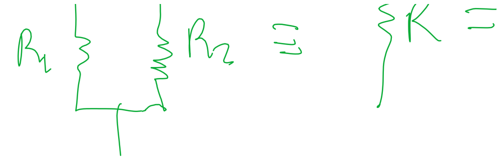
KVL expressions

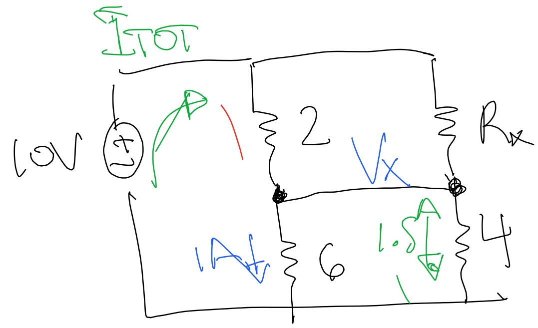
① $10V - i_1(2\Omega) - ($

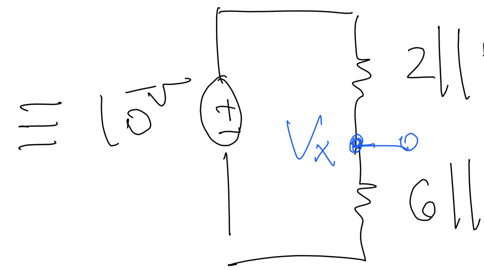
② $-10V - (i_2 - i_3)4\Omega -$

③ $(i_3 - i_2)(4\Omega) - (i_3$







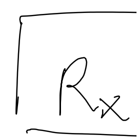


$$\frac{V_x}{4\Omega} = 1.5A$$

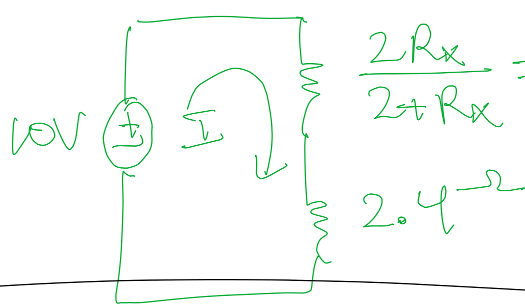
$$V_x = 1A \times 6\Omega = 6V$$

$$V_x = 6V = \frac{R_2}{R_1 + R_2} 10V$$

$$\frac{6V}{10V} = \frac{2.4\Omega}{2.4\Omega + \frac{2R_x}{2+R_x}} \rightarrow$$



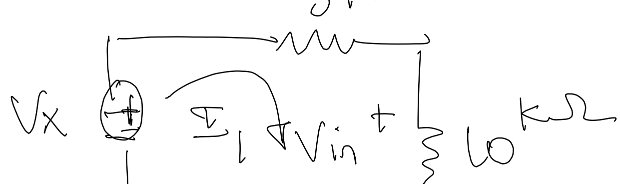
$$I_{TOT} = 1A + 1.5A = 2.5A$$

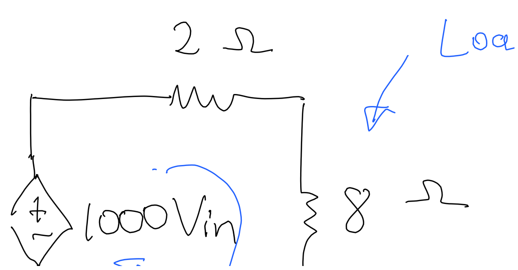


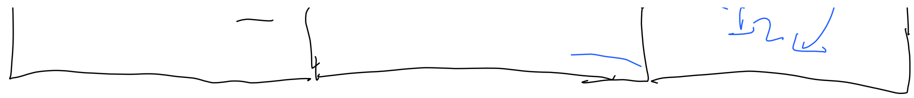
$$\frac{2R_x}{2+R_x} = 1.6\Omega$$

$$I = \frac{10V}{(1.6\Omega + 2.}$$

Problem 2







* 8W are delivered to the load (8Ω resi

$P = I^2 R$

$\rightarrow I_2^2 = \frac{8W}{8\Omega} \rightarrow \boxed{I_2 = 1A}$

(2) $1000V_{in} - I_2(2\Omega) - I_2(8\Omega) = 0$

$1000V_{in} = 10V$

$\rightarrow V_{in} = \frac{10V}{1000} = 10mV$

* What must V_x (source) = ?

$V = IR$

$I = \frac{V}{R}$

$V_{IN} = I_1(10k\Omega) = 10mV$

$I_1 = \frac{10mV}{10k\Omega} = 1\mu A$

(1) $V_x - I_1(5k\Omega) - I_1(10k\Omega) = 0$

$V_x = I_1(15k\Omega) = \boxed{15mV}$