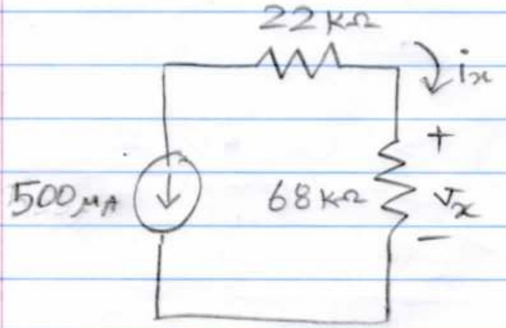
MAE 140
HW #2
Winter 2014

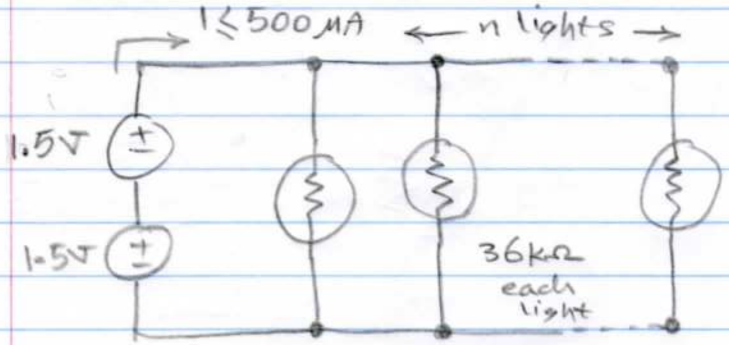
$\boxed{2-25}$



$i_x = -500\,\mu A$

$v_x = (68\,k\Omega) \times (i_x) = 68 \times 10^3 \times (-500) \times 10^{-6} = -34\,V$

2-28



$$V_{total} = 1.5 + 1.5 = 3\,V$$

$$i_{max} = 500\,\mu A$$

$$V_{total} = R_{eq}\, i_{max} \Rightarrow R_{eq} = \frac{3}{500 \times 10^{-6}} = 6\,k\Omega$$

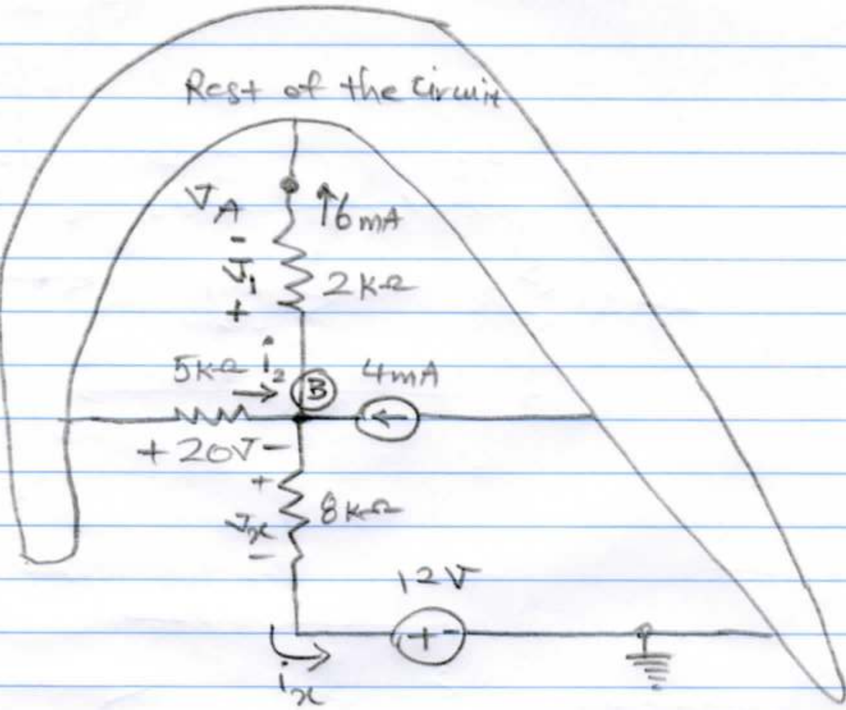
Resister equivalent of possible lights

Parallel of "n" resistors (R_{eq});

$$\frac{1}{R_{eq}} = \underbrace{\frac{1}{36k\Omega} + \frac{1}{36k\Omega} + \cdots}_{n}$$

$$\Rightarrow \frac{1}{R_{eq}} = \frac{n}{36k\Omega} \xrightarrow[R_{eq} = 6k\Omega]{} n = 6$$

2-32



(a) Elements equations

$$\begin{cases} v_1 = 2k\Omega \times 6mA = 12V \\ 20V = 5k\Omega \times i_2 \Rightarrow i_2 = 4mA \\ v_x = 8k\Omega \times i_x \end{cases}$$

KCL at (B): $-6mA + i_2 + 4mA - i_x = 0 \Rightarrow i_x = 2mA$

Thus, $v_x = 8k\Omega \times 2mA$
$= 16V$

(b) Sum of the currents into the rest of the circuit is as;

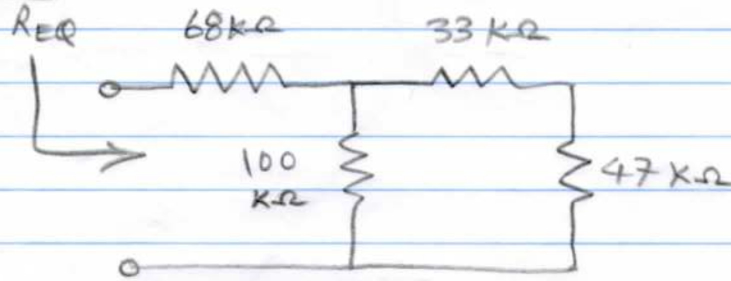
$$6mA - i_2 - 4mA + i_x = 6mA - 4mA - 4mA + 2mA$$
$$= 0\,mA$$

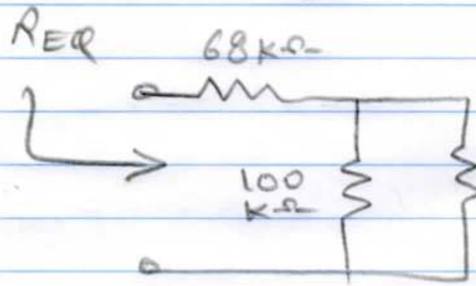
(c) $v_1 = 12V$ ← this is voltage accross the 2kΩ resistor

v_A with respect to the ground (⏚) is as;

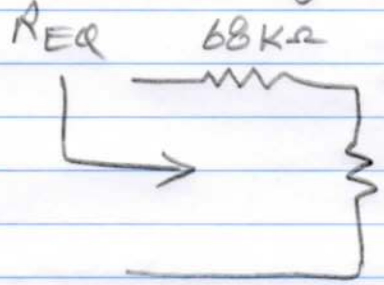
$$v_A = -v_1 + v_x + 12 = -12 + 16 + 12 = 16V$$

$\boxed{2-36}$





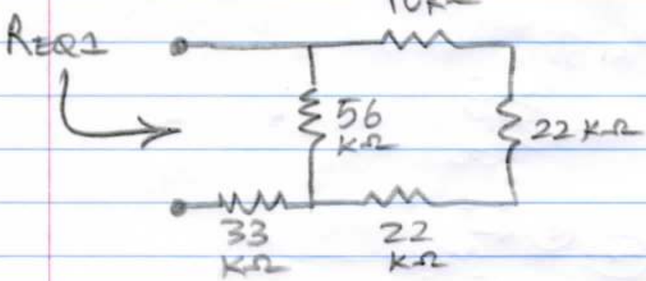
$33 + 47 = 80\,k\Omega$



$100 \| 80 = \frac{100 \times 80}{100 + 80} = 44.4\,k\Omega$

$\Rightarrow R_{EQ} = 68 + 44.4 = 112.4\,k\Omega$

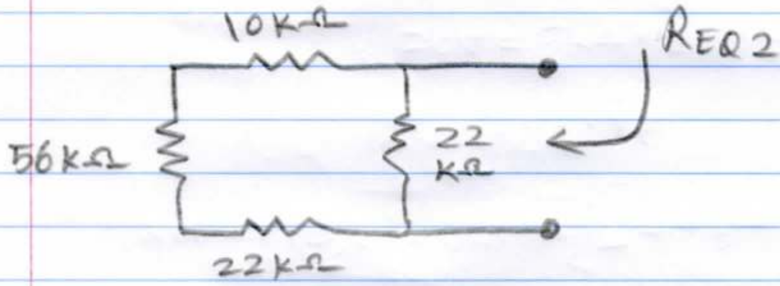
2-38



$10+22+22=54\ k\Omega$

$56 \| 54 = \frac{56 \times 54}{56+54} = 27.49\ k\Omega$

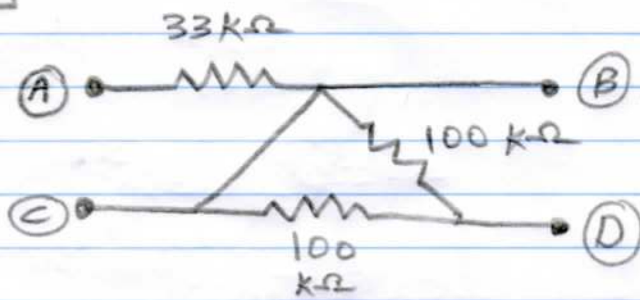
$\Rightarrow R_{EQ1} = 27.49+33 = 60.49\ k\Omega$



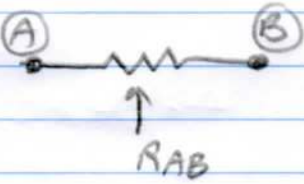
$56+10+22 = 88\ k\Omega$

$\Rightarrow R_{EQ2} = 88 \| 22 = 17.6\ k\Omega$

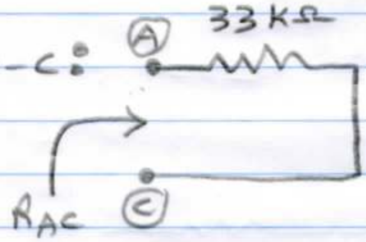
$\boxed{2-43}$



A–B: $R_{AB} = 33\,K\Omega$

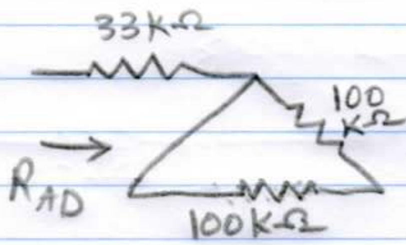


A–C:



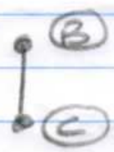
$\Rightarrow R_{AC} = 33\,K\Omega$

A–D:



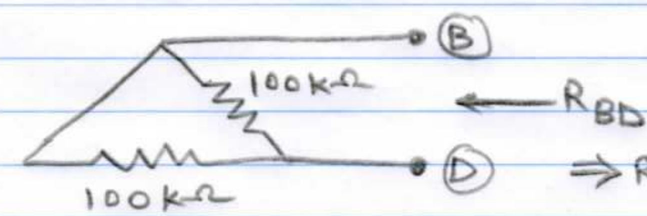
$\Rightarrow R_{AD} = (100 \| 100) + 33$
$= 83\,K\Omega$

B–C:



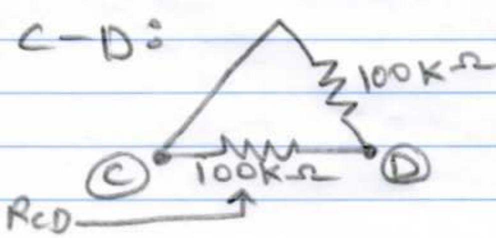
$\Rightarrow R_{BC} = 0\,K\Omega$

B–D:



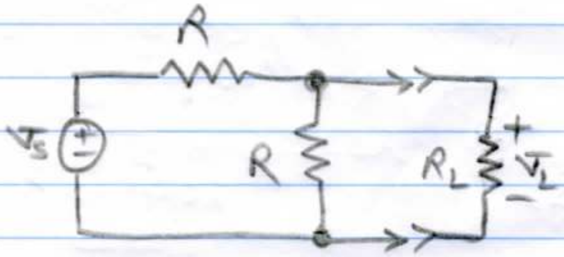
$\Rightarrow R_{BD} = 100 \| 100 = 50\,K\Omega$

C–D:

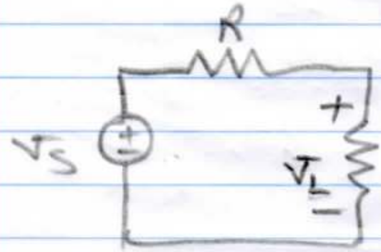


$\Rightarrow R_{CD} = 100 \| 100 = 50\,K\Omega$

$\boxed{2-55}$



$$\Downarrow$$

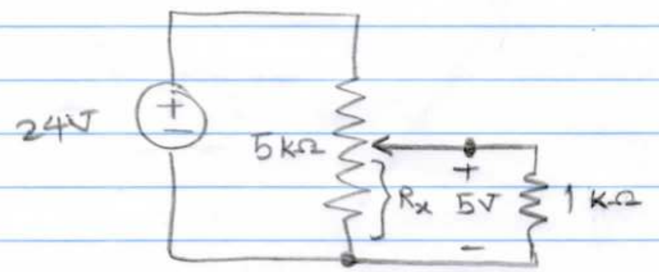


$$R \| R_L = \frac{RR_L}{R+R_L}$$

Voltage division rule:

$$V_L = \frac{\left(\frac{RR_L}{R+R_L}\right)(V_S)}{R + \frac{RR_L}{R+R_L}} = \frac{R_L V_S}{2R_L + R}$$

$\boxed{2-60}$



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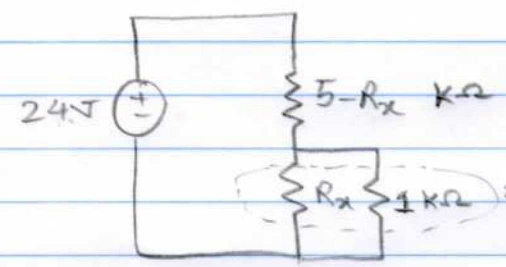


$= R_x \| 1 = \dfrac{R_x}{1+R_x}$ kΩ

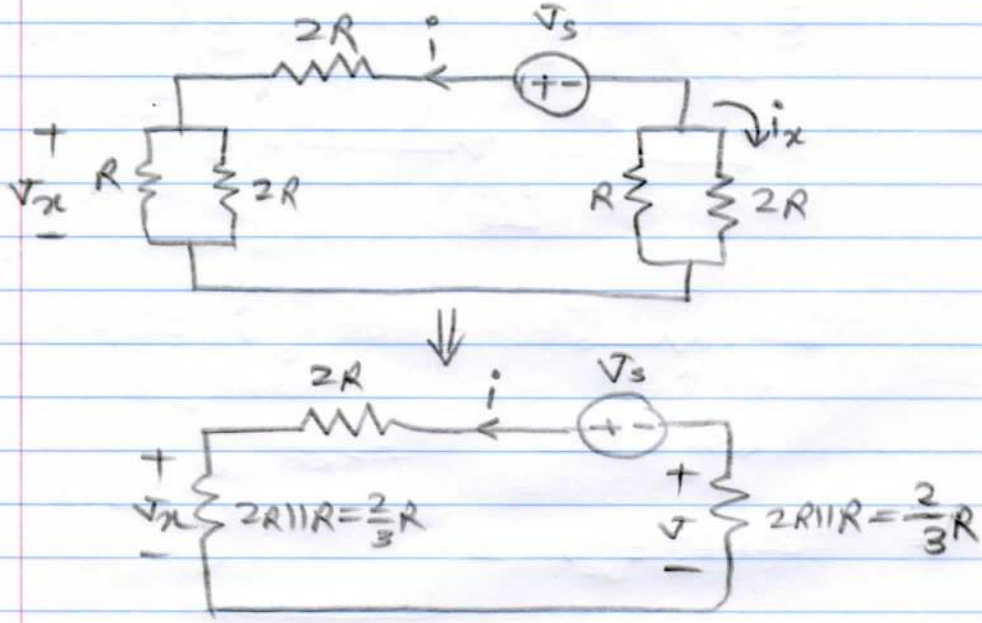
Use voltage division rule, we can obtain the voltage accross $\dfrac{R_x}{1+R_x}$ which is 5V as;

$$V = \frac{\left(\frac{R_x}{1+R_x}\right)(24)}{5-R_x+\frac{R_x}{1+R_x}}$$

$$\Rightarrow 5 = \frac{\left(\frac{R_x}{1+R_x}\right)(24)}{5-R_x+\frac{R_x}{1+R_x}}$$

$$\Longrightarrow R_x \simeq 2.34 \text{ k}\Omega$$

$\boxed{2\text{-}70}$



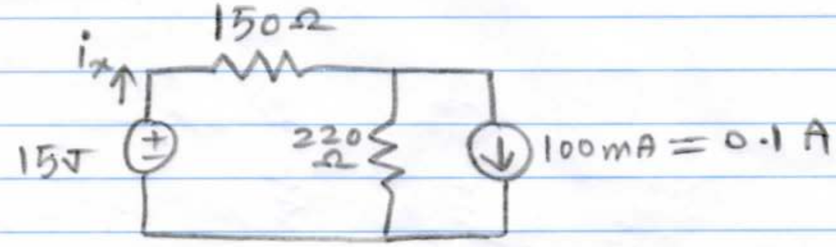
Voltage division:

$$v_x = \frac{2/3\,R}{2R + 2/3\,R + 2/3\,R} \times v_s = 0.2\,v_s$$

Note that $v = -v_x = -0.2\,v_s$

$$\Rightarrow i_x = \frac{-0.2\,v_s}{2R} = -\frac{v_s}{10R}$$

2-73



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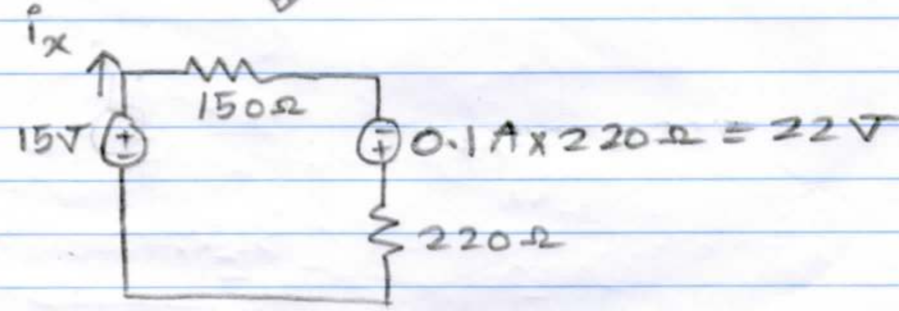

Using KVL:

$$-15 + 150 i_x - 22 + 220 i_x = 0$$

$$\Rightarrow i_x = 0.1 A = 100 mA$$