$\boxed{28-6}$

Only 1 Loop

i) $I = \mathcal{E}/(R+r)$

$320 \times 10^{-3} A = \mathcal{E}/(18.5\,\Omega + .25\,\Omega)$

$$\boxed{\mathcal{E} = 6.00\,V}$$

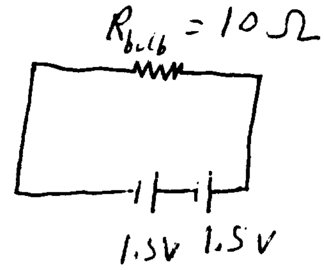
ii) $V_{Terminal}$

$V_{Term} = \mathcal{E} - Ir = 6.00\,V - (320 \times 10^{-3} A)(0.25\,\Omega)$

$$\boxed{V_{Term} = 5.92\,V}$$

$\boxed{28-17}$

a)

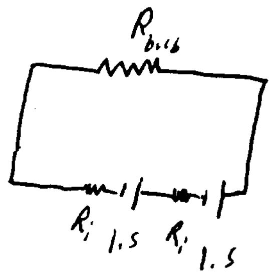


$$I_0 = 2\,\mathcal{E}/R = \frac{2(1.5\,V)}{10\,\Omega} = 0.30\,A$$

All power is dissapated Through R_{bulb}

$$P_0 = I_0^2 R = (0.30\,A)^2 (10\,\Omega) = \boxed{0.90\,W}$$

b)



$$P = I^2 R$$

$$\frac{2}{3}(0.90\,W) = I^2 (10\,\Omega)$$

$$I = .25\,A$$

$\therefore$ For a single Loop

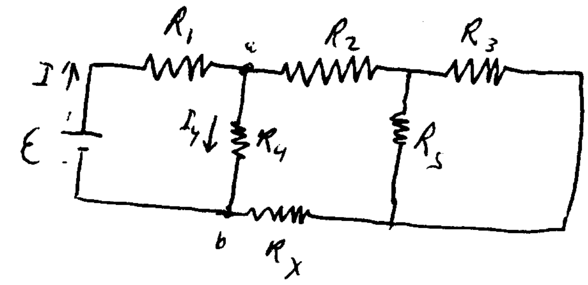
$$I = \frac{2\,\mathcal{E}}{R + 2r}$$

$$0.25\,A = \frac{2(1.5\,V)}{10\,\Omega + 2r}$$

$$\boxed{r = 1.0\,\Omega/\text{battery}}$$

$\boxed{28-34}$

Reduce To single Loop

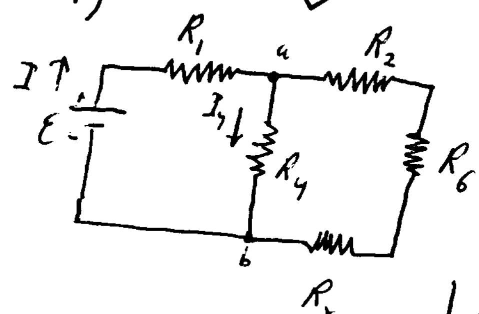


1) combine R_3 & R_5

$$1/R_6 = \frac{1}{R_3} + \frac{1}{R_5} = \frac{1}{3\Omega} + \frac{1}{6\Omega}$$

$$R_6 = 2\Omega$$

1)

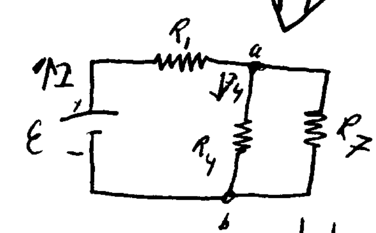


2) Combine R_2, R_6, and R_x

$$R_7 = R_2 + R_6 + R_x = 4\Omega + R_x$$

$$(2\Omega + 2\Omega + R_x)$$

2)

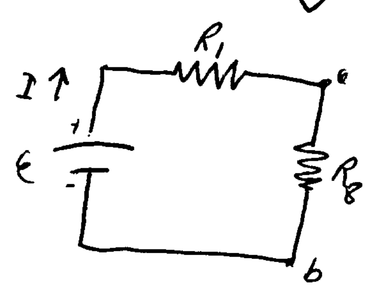


3) Combine R_4 and R_7

$$\frac{1}{R_8} = 1/R_4 + 1/R_7 = \frac{1}{4\Omega} + \frac{1}{4\Omega + R_x}$$

$$R_8 = \left(\frac{16 + 4R_x}{8 + R_x}\right)\Omega$$

3)



4) find current in single Loop

$$I = \mathcal{E}/(R_1 + R_8) \Rightarrow \frac{24V}{1\Omega + \left(\frac{16+4R_x}{8+R_x}\right)\Omega}$$

$$= \frac{24(8+R_x)}{24+5R_x}\ A$$

(continued on next page)

$\boxed{28-34 \text{ Cont.}}$

5) Use The voltage across R_8 and across R_4

$$V_{ab} = I R_8 = I_4 R_4$$

$$\left(\frac{24(8+R_x)}{24+5R_x}\right)\left(\frac{16+4R_x}{8+R_x}\right) = I_4 (4\Omega)$$

Solve for I_4

$$\boxed{I_4 = \frac{24(4+R_x)}{24+5R_x}}$$

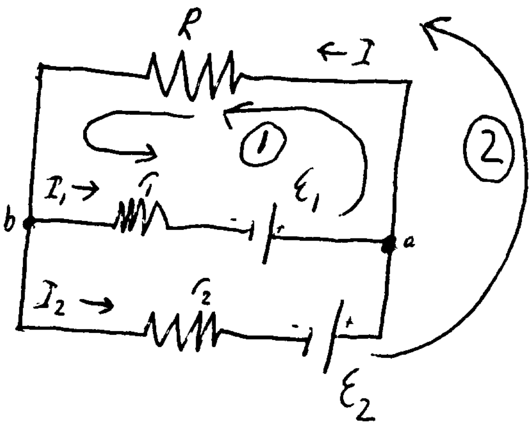
6) find The power dissipated Through R_4

$$P_4 = I_4^2 R_4$$

$$= \left(\frac{24(4+R_x)}{24+5R_x}\right)^2 4\Omega =$$

$$\boxed{P_4 = \left[\frac{48(4+R_x)}{24+5R_x}\right]^2 W}$$

$\boxed{28-37}$



From conservation of current $I - I_1 - I_2 = 0$

Loop 1: $\mathcal{E}_1 - I_1 r_1 - IR = 0$

$+12\,V - I_1(0.1\,\Omega) - I(5\,\Omega) = 0$

Loop 2: $\mathcal{E}_2 + I_2 r_2 - IR = 0$

$+10 - I_2(10\,\Omega) - I(5\,\Omega) = 0$

Solve:

$\underline{I_1 = 2.52\,A}$ $\underline{I_2 = -0.17\,A}$ $\underline{I = 2.35\,A}$

$\therefore$ Current Through R is $\boxed{2.35\,A}$

$\boxed{\mathcal{E}_1 \text{ Supplies } 2.52\,A}$ $\boxed{\mathcal{E}_2 \text{ supplies No Current}}$

(it is being charged by $\mathcal{E}_1$)

$\boxed{27-49}$

$$E = \langle K.E \rangle = \tfrac{3}{2} kT$$

$$Si: (1.1\,eV)(1.6 \times 10^{-19}\,J/eV) = \tfrac{3}{2}(1.38 \times 10^{-23}\,J/K)\,T_{Si}$$

$$\boxed{T_{Si} = 8.5 \times 10^{3}\,K}$$

$$Ge: (0.7\,eV)(1.6 \times 10^{-19}\,J/eV) = \tfrac{3}{2}(1.38 \times 10^{-23}\,J/K)\,T_{Ge}$$

$$\boxed{T_{Ge} = 5.4 \times 10^{3}\,K}$$

$$C: (6.0\,eV)(1.6 \times 10^{-19}\,J/eV) = \tfrac{3}{2}(1.38 \times 10^{-23}\,J/K)\,T_{C}$$

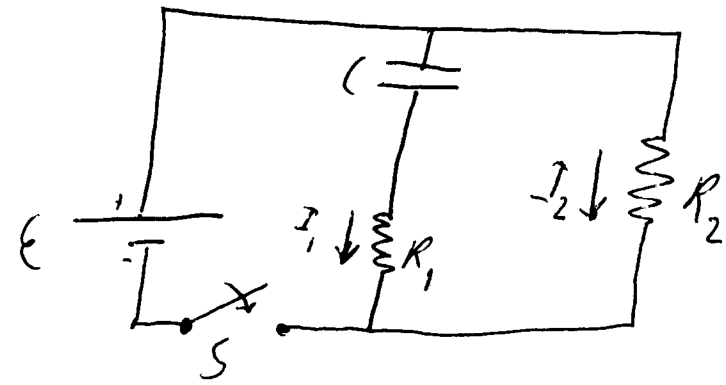
$$\boxed{T_{C} = 4.6 \times 10^{4}\,K}$$

$\boxed{28-47}$

$$V_{meter} = I_G R_G = I_S R_S \qquad R_G/R_S = I_S/I_G$$

$$I = I_G + I_S = I_G\left[1 + I_S/I_G\right] = \underline{\underline{I_G\left[1 + R_G/R_S\right]}}$$

$\boxed{28-59}$



Current in R_2 is constant:

$$I_2 = \mathcal{E}/R_2$$

The charging current in the capacitor branch is:

$$I_1 = \frac{\mathcal{E}}{R_1} e^{-t/R_1 C}$$

So the current in the battery is

$$\boxed{I_{battery} = I_1 + I_2 = \left(\frac{\mathcal{E}}{R_1}\right) e^{-t/R_1 C} + \left(\frac{\mathcal{E}}{R_2}\right)}$$