HW03

1. $2.7\text{kJ} / 6.3\text{ mW} = 2.7 \cdot 10^3\ \text{J} / 6.3 \cdot 10^{-3}\ \text{W}$

$= 0.429 \cdot 10^6\ \text{s}$

$= \boxed{4.29 \cdot 10^5 \text{ seconds}}$

2. $I = 25\text{W} / 12\text{V} = 2.083\text{A}$

$57\text{Ah} / 2.083\text{A} = \boxed{27.364 \text{ hours}}$

3. $I = P/V$

$P = E/t$

$I = E/V \cdot t$

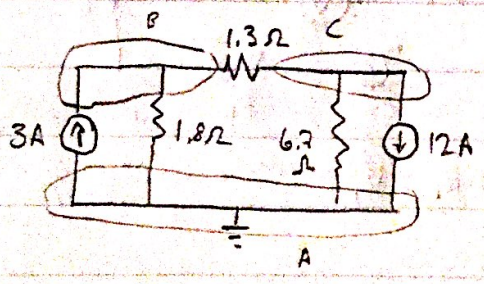
$t = E/V \cdot I = 79\text{J} / 2.4\text{V} \cdot 3.05 \cdot 10^{-6}\text{A}$

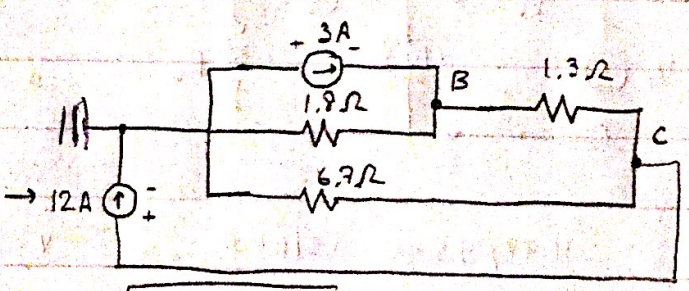
$= \boxed{1.079 \cdot 10^7 \text{ seconds}}$

average current $= 0.5\,\mu\text{A} \cdot \frac{59}{60} + 154\,\mu\text{A} \cdot \frac{1}{60}$

$= 3.05\,\mu\text{A}$

4.

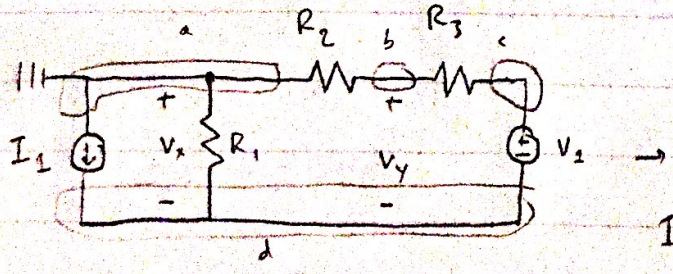


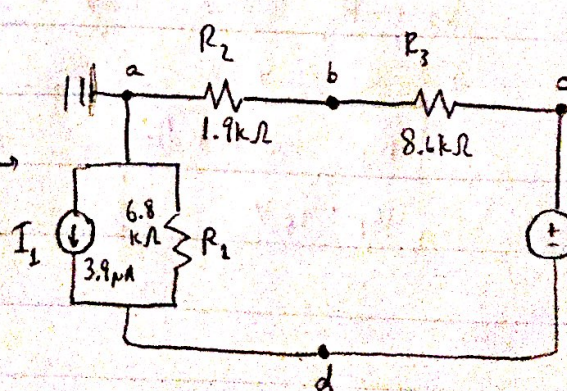


$\boxed{V_2 = -5.4\text{V}}$

$\boxed{V_2 = -40.2\text{V}}$

6.





$R_{eq} = R_1 + R_2 + R_3$

$= 17.3\text{k}\Omega$

0.277mA

$V_x = -3.9\mu\text{A} \cdot 6.8\text{k}\Omega + -0.277\text{mA} \cdot 6.8\text{k}\Omega$

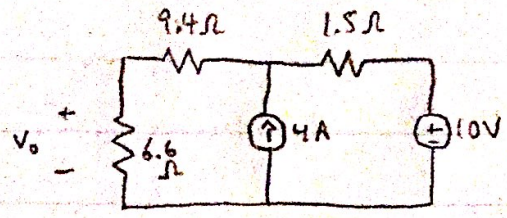
$= \boxed{-1.91\text{V}}$

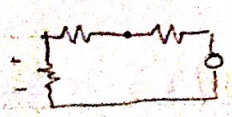
$V_y = -3.9\mu\text{A} \cdot 1.9\text{k}\Omega + -0.277\text{A} \cdot 1.9\text{k}\Omega + -1.91\text{V}$

$= \boxed{-2.44\text{V}}$

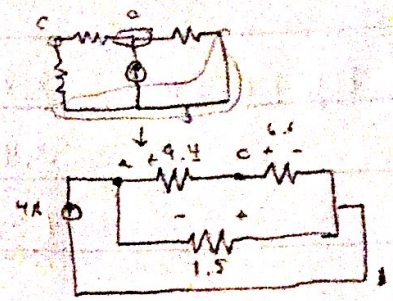
HW03

5.





&



10V → $R_{eq} = 6.6 + 9.4 + 1.5 = 17.5\Omega$

$I = V/R_{eq} = 10V/17.5\Omega = 0.57A$

$V_o = 0.57A \cdot 6.6\Omega$

$V_{o_1} = 3.77V$

4A → $R_{eq} = \frac{1}{\frac{1}{1.5} + \frac{1}{16}} = 1.37\Omega$

$V = 1.37\Omega \cdot 4A$

$= 5.48V$

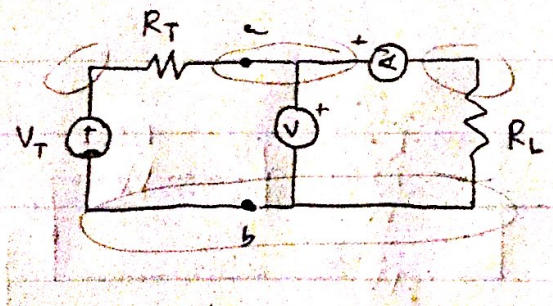
$V_{branch} = 5.48/2 = 2.74V$

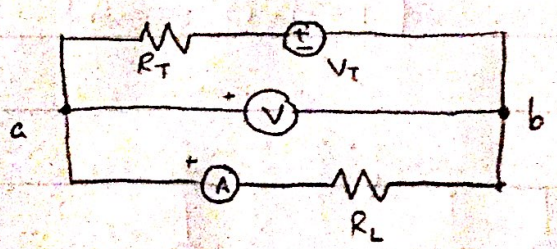
$I_{branch} = 2.74V/16\Omega = 0.17125A$

$V_{o_2} = 0.17125A \cdot 6.6\Omega = 1.13V$

$V_o = V_{o1} + V_{o2} = 3.77V + 1.13V = \boxed{4.9V}$

7. a)





$4.9V/9.5mA = 0.516k\Omega$

$9.2V/3.8mA = 2.42k\Omega$

$V_T + R_T \cdot 9.5mA = 4.9V$

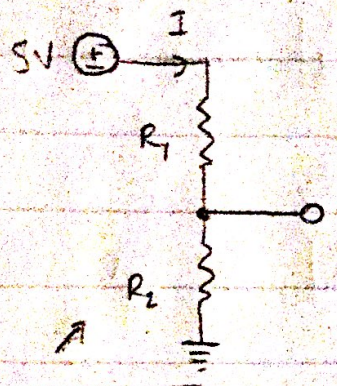
$V_T + R_T \cdot 3.8mA = 9.2V$

$5.7\ R_T = -4.3V$

$V = A \cdot R_L = V_T$

$\boxed{\begin{aligned} R_T &= -0.75k\Omega \\ V_T &= 12V \end{aligned}}$

8. Can use a voltage divider circuit



$5V = I \cdot (R_1 + R_2)$

$3V = I \cdot R_2$

$I = \frac{5V}{R_1 + R_2}$

$3V = \frac{5V}{R_1 + R_2} \cdot R_2$

$5R_2 = 3(R_1 + R_2)$

$2R_1 + R_2 = 1k\Omega$

$5R_2 = 3k\Omega$

$R_2 = 0.6k\Omega$

$2R_1 = 0.4k\Omega$

$R_1 = 0.4k\Omega$
$R_2 = 0.6k\Omega$

9. $39 = 2 \cdot 16^1 + 7 \cdot 16^0 =$ 0x27

$39 = 2^5 + 1 \cdot 2^2 + 1 \cdot 2^1 \cdot 1 \cdot 2^0 =$ 0b100111

10. $0xff0a = 15 \cdot 16^3 + 15 \cdot 16^2 + 0 + 10$

$= 61440 + 3840 + 10 =$ 65290

11. $1 \cdot 2^{16} + 1 \cdot 2^{14} + 1 \cdot 2^{12} + 1 \cdot 2^8 + 1 \cdot 2^5$

$=$ 0b1010100010010000

16 digits

288