PHYS 605 HW 1

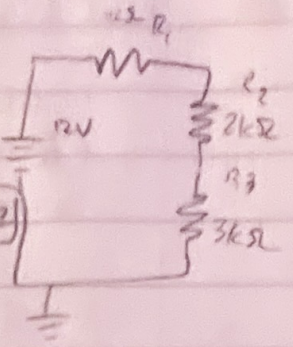
1.a) $V_2 = 12V - IR_1$ $\quad 12V = I \cdot R_T \Rightarrow I = \frac{12}{6000} A$

$V_3 = 12V - IR_1 - IR_2$ $\quad I = \frac{1}{500} A \rightarrow$ doesn't change

$12V - IR_1 - IR_2 - IR_3 = 0$

$\boxed{V_2 = 10V}$

$\boxed{V_3 = 6V}$

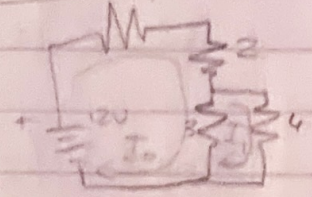


b) $P = I^2R \Rightarrow P_1 = \left(\frac{1}{500}\right)^2 \cdot 1000 = \boxed{0.004\,W}$

$P_2 = \left(\frac{1}{500}\right)^2 \cdot 2000 = \boxed{0.008\,W}$

$P_3 = \left(\frac{1}{500}\right)^2 \cdot 3000 = \boxed{0.012\,W}$

c) $V_2 = 10V, V_3 = 6V$



d)

$12V - I_0R_1 - I_0R_2 - I_0R_3 = 0$

$6V - I_1R_4 = 0 \Rightarrow I_1 = \frac{6V}{R_4} = \boxed{6\,mA \text{ through } R_4}$

$12V - I_0(R_1 + R_2 + R_3) = 0$

$I_0 = \frac{12V}{6\times10^3} = \boxed{2\,mA}$ through R_1, R_2, R_3

2.a) $R_n = \boxed{5.375k\Omega}$

b) $P = I^2R$, $P_n = I^2R_n = \boxed{2.15\,W}$

$P_s = I^2R_s = \boxed{0.05\,W}$

c) $P_{total} = 2.2W$

$\frac{2 \cdot 0.05}{2.2W} = \frac{0.04W}{2.2W} = \boxed{1.82\%}$ ∴

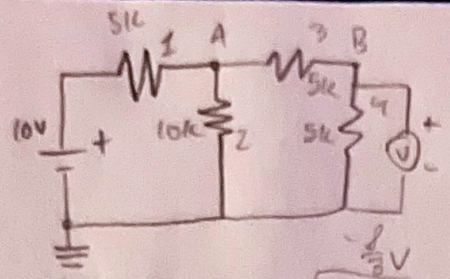
$R_s = \frac{2.5}{0.02}$

$I_{max} = 20mA$

$R_{total} = R_n + R_s$

$I_{max} = \frac{V_{Total}}{R_{tot}}$

$R_n = \frac{V_{tot}}{I_{max}} - R_s = 5.375k\Omega$

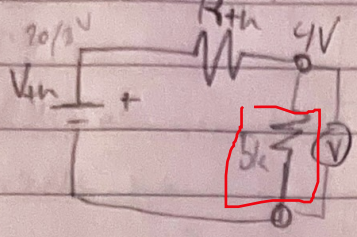


$\frac{1}{3}V$

3.a)

$R_{Th} = \frac{10}{3}k\Omega$

$V_{Th} = \frac{20}{3}V$

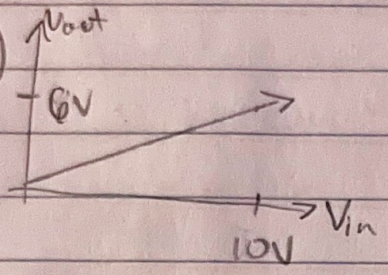


$V_{Th} = \frac{V_S R_2}{R_1+R_2} = \frac{100\,V\cdot k\Omega}{15\,k\Omega}$

$V_{Th} = \frac{20}{3}V$

$R_{Th} = \frac{R_1 R_2}{R_1+R_2} = \frac{50}{15} = \frac{10}{3}k\Omega$

b)



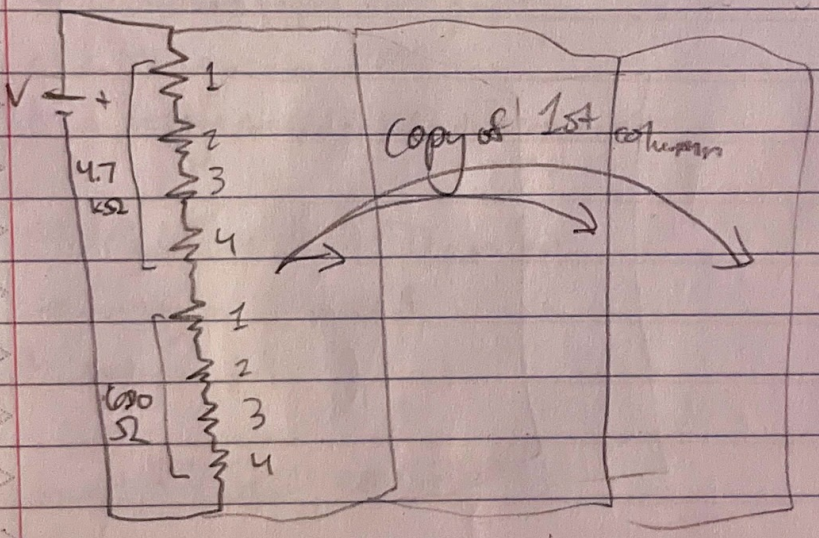
$R_T = \frac{15}{3}+\frac{40}{3} = 25/3\,k\Omega$

$I = \frac{V_S}{R_T} = \frac{20}{25} = 0.8mA$

$V_4 = 5k\Omega \cdot 0.8mA = 4V$

$V_{mon} = 0.6\,V_{in}$

4.a) $4.7 + .68 = 5.680k\Omega$



b) $\frac{I_0}{4} = I$ for all 4 loops, $4.7k\Omega$ bleeds first

$\frac{1}{4.7k\Omega} = I_0/4 \Rightarrow I = 20.6\,mA$

$\Rightarrow V = IR = 20.6\times10^{-3}\cdot 5.4\times10^{3} = 14.39V$