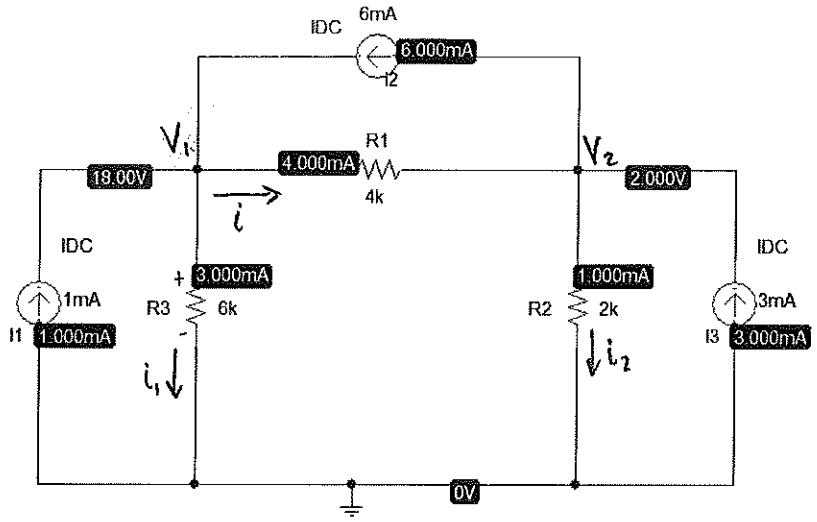
Jared Fowler

Lab 2 – PSPICE

P1.



KCL @ V_1:

$1mA + 6mA = i + i_1$

$7mA = \frac{V_1 - V_2}{4K} + \frac{V_1 - 0}{6K}$

$7mA = \frac{V_1}{4K} - \frac{V_2}{4K} + \frac{V_1}{6K}$

$7mA = \frac{3V_1}{12K} - \frac{3V_2}{12K} + \frac{2V_1}{12K}$

$84 = 5V_1 - 3V_2$ (1)

KCL @ V_2:

$i + 3mA = 6mA + i_2$

$3mA = i - i_2$

$3mA = \frac{V_1 - V_2}{4K} - \left(\frac{V_2 - 0}{2K}\right)$

$3mA = \frac{V_1}{4K} - \frac{V_2}{4K} - \frac{V_2}{2K}$

$3mA = \frac{V_1}{4K} - \frac{V_2}{4K} - \frac{2V_2}{4K}$

$12 = V_1 - 3V_2$ (2)

$84 = 5(12 + 3V_2) - 3V_2$

$84 = 60 + 12V_2$

$12V_2 = 24$

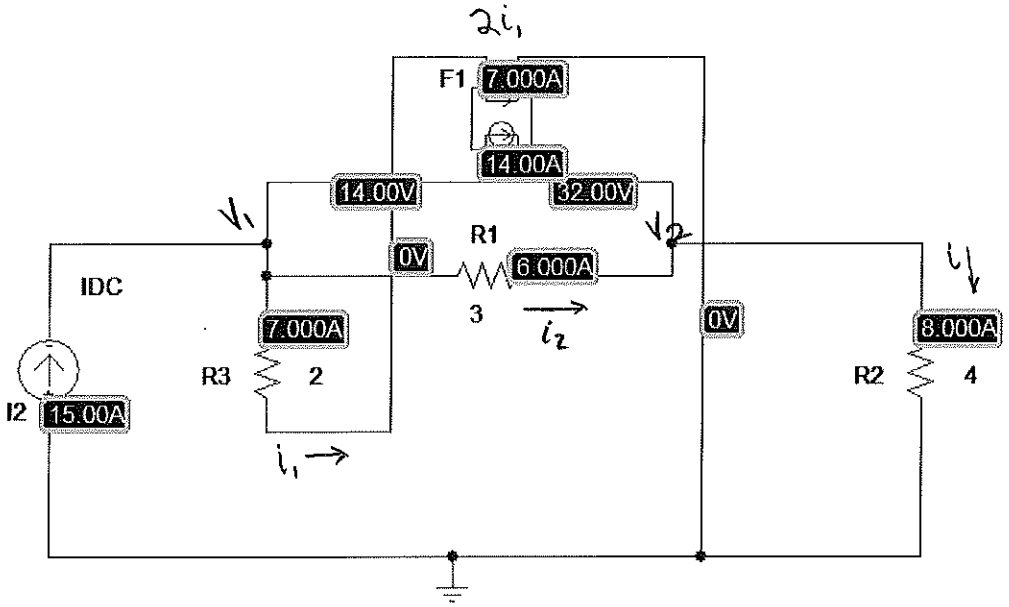
$\boxed{V_2 = 2V}$ ✓

$12 = V_1 - 3(2)$

$\boxed{V_1 = 18V}$ ✓

$i = \frac{V_1 - V_2}{4K} = \frac{18 - 2}{4K} = \boxed{4mA}$ ✓

P2.



KCL @ V_1:

$15A = i_1 + i_2 + 2i_1$

$15A = 3i_1 + i_2$

$15A = 3\left(\frac{V_1-0}{2}\right) + \left(\frac{V_1-V_2}{3}\right)$

$15A = \frac{3V_1}{2} + \frac{V_1}{3} - \frac{V_2}{3}$

$15A = \frac{9V_1}{6} + \frac{2V_1}{6} - \frac{2V_2}{6}$

$90 = 11V_1 - 2V_2 \quad (1)$

KCL @ V_2:

$i = 2i_1 + i_2$

$\frac{V_2-0}{4} = 2\left(\frac{V_1-0}{2}\right) + \left(\frac{V_1-V_2}{3}\right)$

$\frac{V_2}{4} = V_1 + \frac{V_1}{3} - \frac{V_2}{3}$

$3V_2 = 12V_1 + 4V_1 - 4V_2$

$7V_2 = 16V_1$

$V_2 = \frac{16}{7}V_1 \quad (2)$

$90 = 11V_1 - 2\left(\frac{16}{7}V_1\right)$

$90 = 11V_1 - \frac{32}{7}V_1$

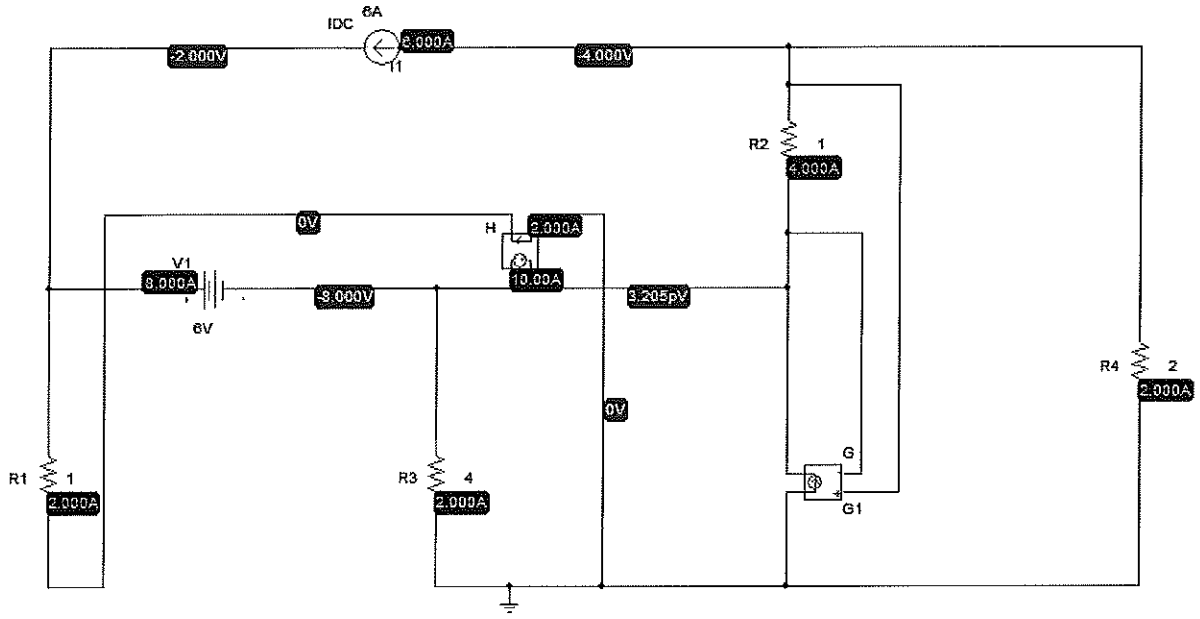
$90 = \frac{45}{7}V_1$

$V_1 = 90\cdot\left(\frac{7}{45}\right) = \boxed{14V}$ ✓

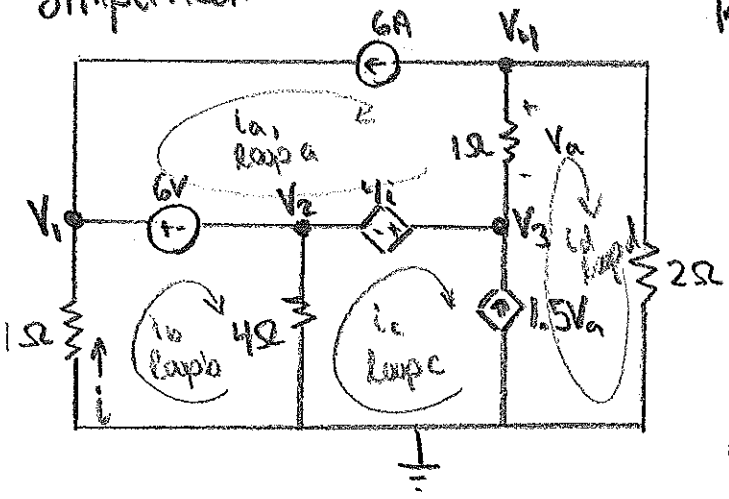
$V_2 = \frac{16}{7}(14) = \boxed{32V}$ ✓

$i = \frac{V_2}{4} = \frac{32}{4} = \boxed{8A}$ ✓

P3.



Simplified:



KVL @ loop a:

$1(i_a - i_d) + 4i - 6V = 0$

$i_a - i_d + 4i - 6 = 0$

Note: $i_a = -6$

$\therefore 4i - i_d = 12$ (2)

→ $i_d = -4$ ...

ask about this...

KVL @ loop b: (Note: $i_b = i$)

$1(i_b + 6 + 4(i_b - i_c) = 0$

$5i_b - 4i_c + 6 = 0$ (1)

KVL @ loop c:

$4(i_c - i_b) - 4i = 0$

$4i_c - 4i_b - 4i = 0$

$4i_c - 8i = 0$

$i_c = 2i$ (3)

(1,3): $5i - 4(2i) + 6 = 0$

$5i - 8i + 6 = 0$

$-3i = -6$

$i = 2$ (5)

& $i_c = 4$ (6)

KVL @ loop d:

$2(i_d + 1(i_d - i_a) = 0$

$2i_d + i_d - i_a = 0$

$3i_d = i_a - 6$

$i_d = -2$ (4)

$\therefore V_1 = iR = -2(1) = \boxed{-2V}$

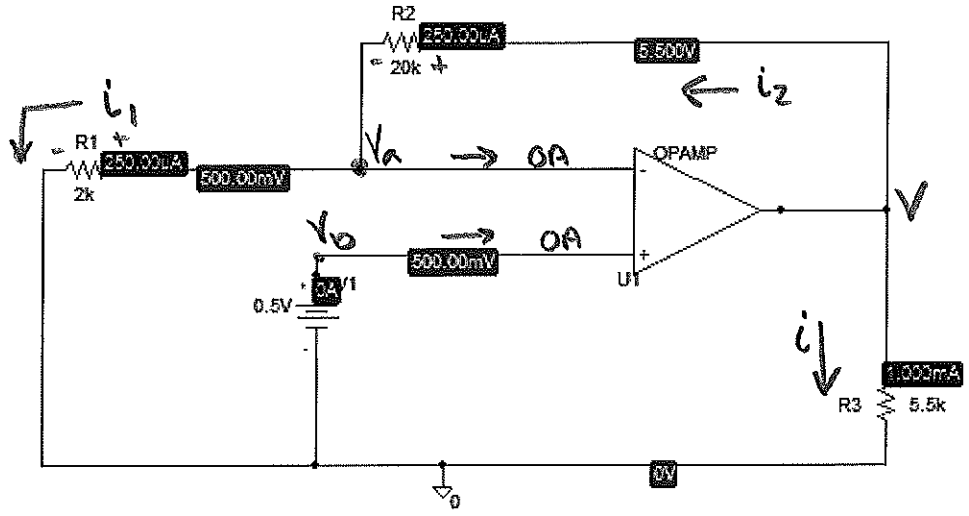
$V_2 = R(i_b - i_c) = 4(2-4) = \boxed{-8V}$

$V_a = 1(i_a - i_d) = -4V$

$V_3 = V_4 - V_a = -4V - (-4V) = \boxed{0V}$

$V_4 = R(i_d) = 2(-2) = \boxed{-4V}$

P4.



KCL @ (-) amp:

$i_2 = i_1 + 0A$

$\frac{V - V_a}{20K} = \frac{V_a - 0}{2K}$

$\frac{V}{20K} - \frac{V_a}{20K} = \frac{V_a}{2K}$

$\frac{V}{20K} - \frac{V_a}{20K} = \frac{10V_a}{10K}$

$V = 11V_a$

Note: Principle of short

$\rightarrow V_a = V_b$

and $V_b = .5V$

$\rightarrow V_a = .5V$

$\therefore V = 11(.5)$

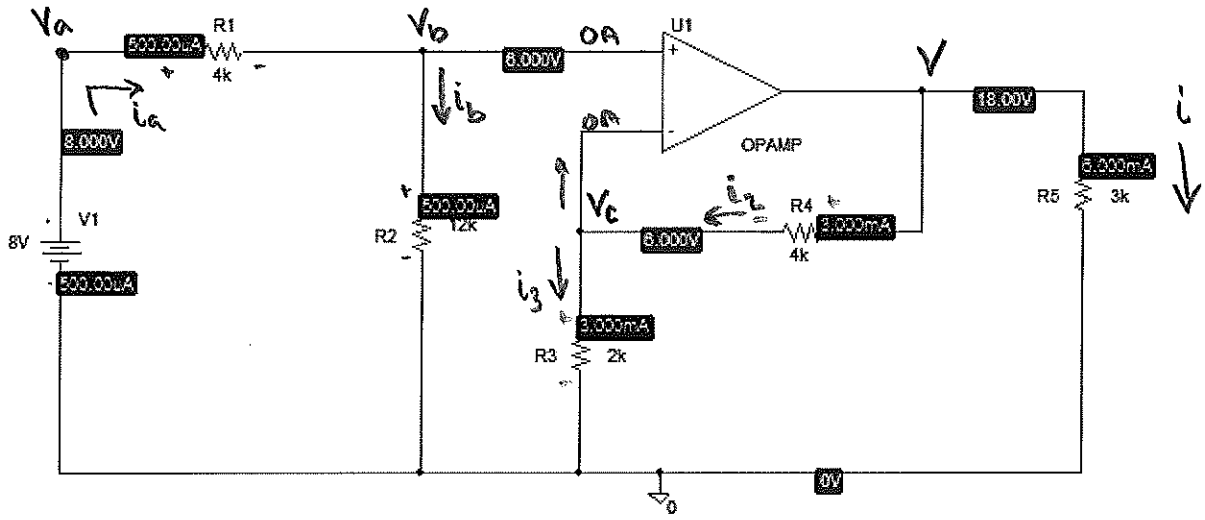
$\boxed{V = 5.5V}$

$V = iR$

$5.5 = i(5.5K)$

$\boxed{i = 1mA}$

P5.



KCL @ (+) amp:

$i_b + OA = i_a$

$\frac{V_b - 0}{12K} = \frac{V_a - V_b}{4K}$

$\frac{V_b}{12K} = \frac{V_a}{4K} - \frac{V_b}{4K}$

$\frac{V_b}{12K} = \frac{3V_a}{12K} - \frac{3V_b}{12K}$

$V_b + 3V_b = 3V_a$

$4V_b = 3V_a$

Note: $V_a = 8V$

$V_b = 3(8)/4$

$V_b = 6V$

By principle of short

$V_b = V_c = 6V$

KCL @ V_c

$i_2 = OA + i_3$

$\frac{V - V_c}{4K} = \frac{V_c - 0}{2K}$

$\frac{V}{4K} - \frac{V_c}{4K} = \frac{V_c}{2K}$

$V - V_c = 2V_c$

$V = 3V_c$

$V = 3(6)$

$V = 18V$

$V = iR$

$18 = i(3K)$

$i = 18/3K$

$i = 6mA$