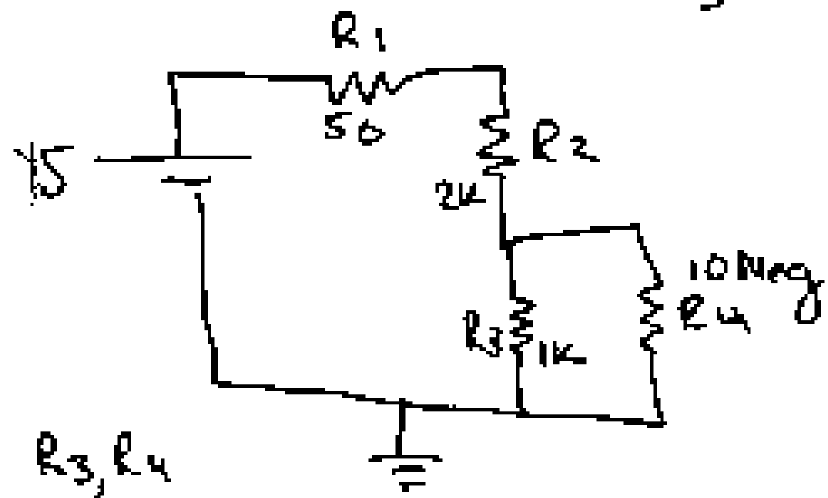
HW #1 Solutions

1. a)



I) combine R_3, R_4 in parallel

$$\frac{R_3 \cdot R_4}{R_3 + R_4} \quad \frac{1K \cdot 10E6}{1K + 10E6} = 999.9 = R_{parallel}$$

II) Replace Resistor in circuit

III) All resistors now in series
Add them

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

$R_{eq} = 50 + 2000 + 999.9$

$R_{eq} = 3049.9 \approx 3050$

B)

I) Do parts C, and D first

II) $V_1 = I_1 R_1$ ohms law

for R_1 $V = .25$ $R = 50$

$I_1 = \frac{.25\,V}{50}$ $\boxed{I_1 = 5\,mA}$

R_2 has the same current because it is in series. THE CURRENT ONLY HAS ONE PATH.

Check. $V_2 = I_2 R_2$ $V_2 = 9.84\,V$ $R_2 = 2000$

$\boxed{I_2 = \frac{9.84\,V}{2000} = 4.92\,mA \approx 5\,mA}$

$V_3 = I_3 R_3$ $V_3 = 4.91$ $R_3 = 1000$

$\boxed{I_3 = \frac{4.91}{1000} = 4.91\,mA}$

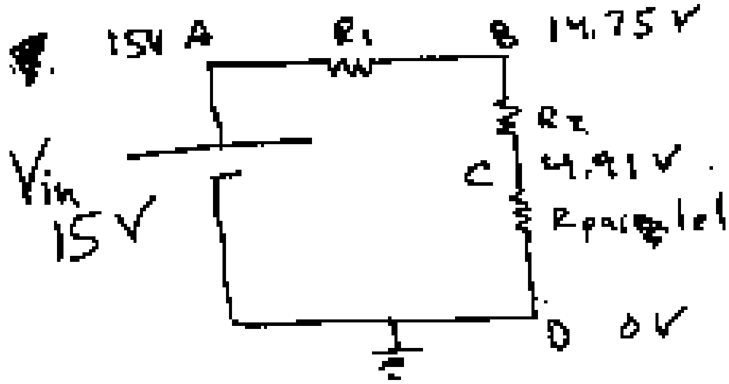
$V_4 = I_4 R_4$ $V_4 = 4.91\,V$ $R_4 = 10\,Meg$

$\boxed{I_4 = \frac{4.91\,V}{10\,Meg} = 491\,nA}$

* Most current goes through R_3 because $R_4 = 10$ Megs is so big. Current takes path of least Resistance.

C) Find Voltage across R_1, R_2, R_3, R_4

use results from D



Check ✓
use KVL
conservation of voltage to calculate the total V drop across all resistors
$V_{in} = V_{R_1} + V_{R_2} + V_{R_{3,4}}$
$V_{in} = 0.25 + 9.84 + 4.91$
$V_{in} = 15$ should be 15

R_1 Voltage across R_1 = A − B
$15 - 14.75$
$\boxed{V_{R_1} = .25\text{ V}}$

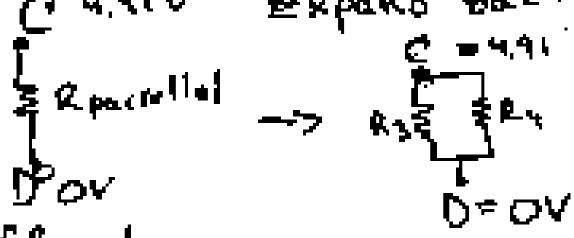
R_2 Voltage across R_2
$B - C = 14.75 - 4.91 = V_{R_2}$ $\boxed{9.84\text{ V}}$

R_3, R_4 Voltage across R_3, R_4 is the same
$V_{R_3,R_4} = C - D = 4.91 - 0$ $\boxed{= 4.91}$ (V_{R_3,R_4})

Expand back to original

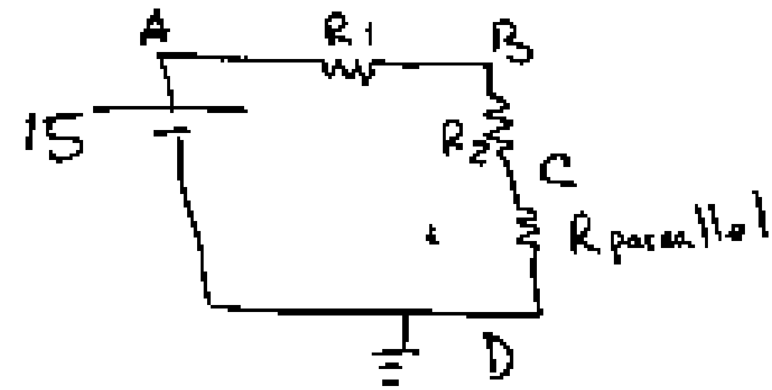
*Why?

Voltage is the same across resistors in parallel
* Current will be different.



D Find voltage at points A, B, C, D

I) use results of part D a) II)



Do voltage divider and observation

A is across voltage supply

A = 15 V

D is at ground

D = 0 V

C use voltage divider

$$V_{out} = \frac{R_x}{R_x + R_y} V_{in}$$

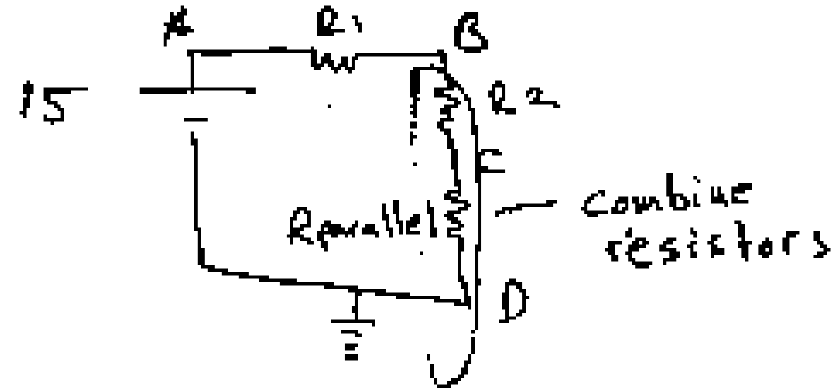
$$V_{at\,C} = \frac{R_{parallel}}{R_{parallel} + R_1 + R_2}(15V) = \frac{1000(15)}{1000 + 50 + 2000}$$

C = 4.91 V

cont. on next sheet

D) Find Voltage at A, B, C, D cont.

B use voltage divider

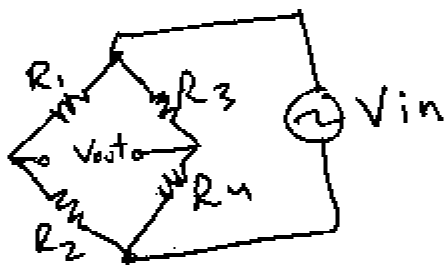


$R_{eq} = R_2 + R_{parallel}$

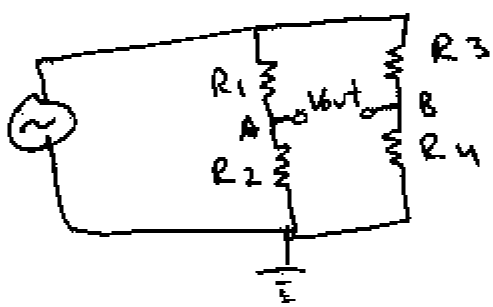
$$V_{at\,B} = \frac{R_{eq}(15)}{R_{eq} + R_1} = \frac{3000(15)}{3000 + 50} = 14.75$$

B = 14.75 V

Wheat Stone Bridge



Follow circuit paths to determine PSPICE Equivilent.



$V_{out} = V_A - V_B$