E. Arrambide | Physics AP/Dual

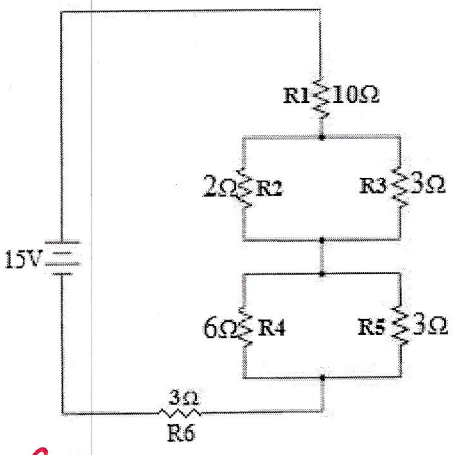
Name: Ivy | Period: ____ Date: ____

Electricity: Combined Electric Circuits problems 2

| SERIES | PARALLEL | V=I/R |
|---|---|---|
| $V=V_1+V_2+V_3$ | $V=V_1=V_2=V_3$ | |
| $I=I_1=I_2=I_3$ | $I=I_1+I_2+I_3$ | $P=IV=I^2R$ |
| $R=R_1+R_2+R_3$ | $\frac{1}{R_T}=\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}$ | |

I. Simplify the following electric circuits and answer the following. Show your work to get full credit. You might need to work the problems in a different sheet of paper.

1.



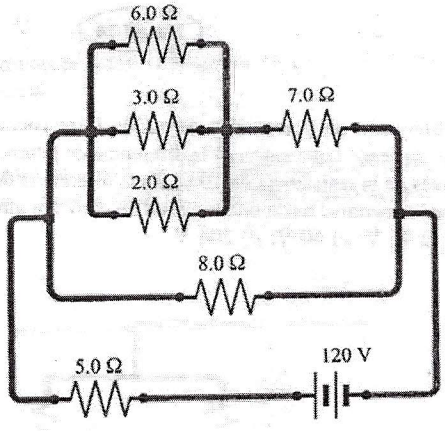

a. Total Resistance in the circuit: 16.2Ω

b. Current flowing in the circuit: 0.93A

c. Voltage
V1 9.3V V2 1.12V V3 1.12V V4 1.86V V5 1.86V V6 2.79V

d. Current
I1 0.93A I2 0.56A I3 0.37A I4 0.31A I5 0.62A I6 0.93A

2.




a. Total Resistance in the circuit: 9Ω

b. Current flowing in the circuit: 13.33A

c. Voltage on the 8Ω resistor: 53.32V

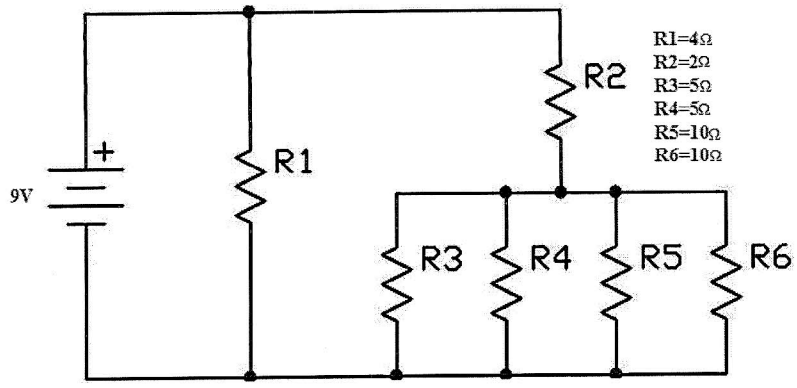
d. Voltage on the 3Ω resistor: 6.67V

e. Current on the 6Ω resistor: 1.11A

f. Current on the 7Ω resistor: 6.67A

g. Current on the 5Ω resistor: 13.33A

3.




a. Total Resistance in the circuit: 1.91Ω

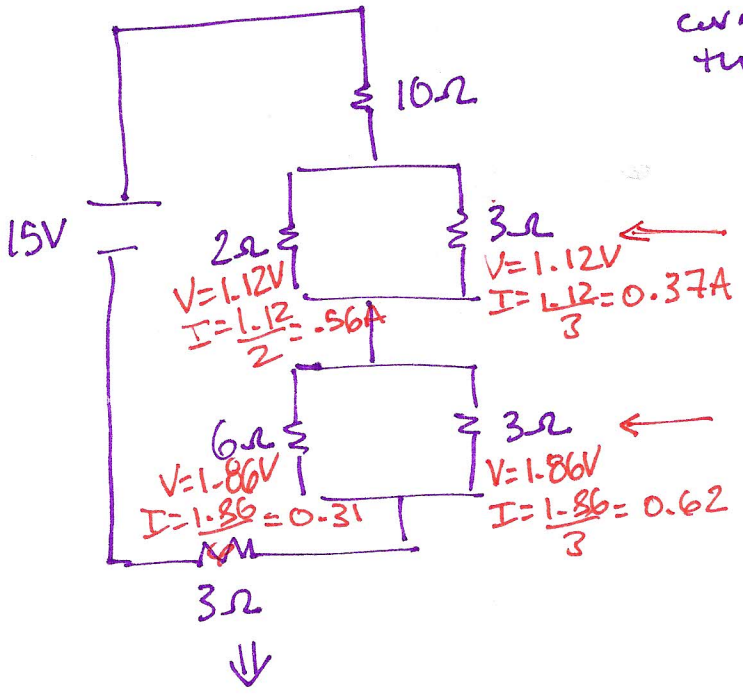
b. Current flowing in the circuit: 4.71A

c. Voltage
V1 9V V2 4.9V V3 4.09V V4 4.09V V5 4.09V V6 4.09V

d. Current
I1 2.25A I2 2.45A I3 0.82A I4 0.82A I5 0.41A I6 0.41A

(1)

STEP 1: Simplify diagrams
STEP 2: Find total resistance
STEP 3: Find total current
STEP 4: Go back & split voltage & current [depending on type of circuit]




Simplify Parallel

$\frac{1}{R_T} = \frac{1}{2} + \frac{1}{3}$ ↕ $\frac{1}{R_T} = \frac{5}{6}$

$\frac{1}{R_T} = \frac{3+2}{6}$

$R_T = \frac{6}{5} = 1.2$

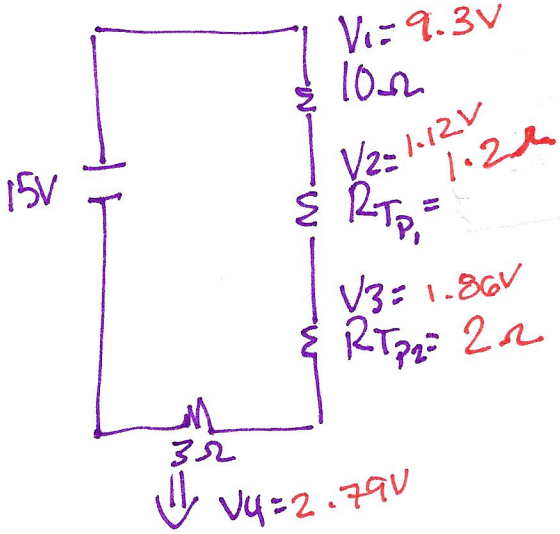
Simplify Parallel

$\frac{1}{R_T} = \frac{1}{6} + \frac{1}{3}$

$\frac{1}{R_T} = \frac{1+2}{6}$

$\frac{1}{R_T} = \frac{3}{6}$

$R_T = \frac{6}{3} = 2\Omega$




Series

$R_T = 10 + 1.2 + 2 + 3$

$R_T = 16.2\Omega$

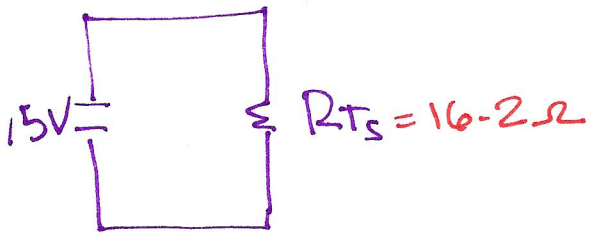
To find voltage split

$V_1 = IR_1 = (.93A)(10) = 9.3V$

$V_2 = IR_{T_{P_1}} = (.93A)(1.2) = 1.12V$

$V_3 = IR_{T_{P_2}} = (.93A)(2) = 1.86V$

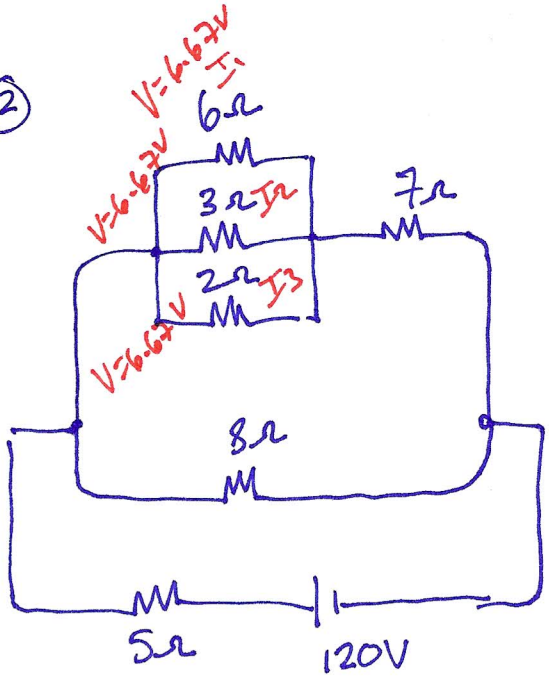
$V_4 = IR_4 = (.93)(3) = 2.79V$




TOTAL CURRENT

$I = \frac{V}{R_T} = \frac{15}{16.2} = 0.93A$

②




Simplify CIRCUIT to Find total Resistance

$$\frac{1}{R_{TP}} = \frac{1}{6} + \frac{1}{3} + \frac{1}{2}$$

$$\frac{1}{R_{TP}} = \frac{1+2+3}{6}$$

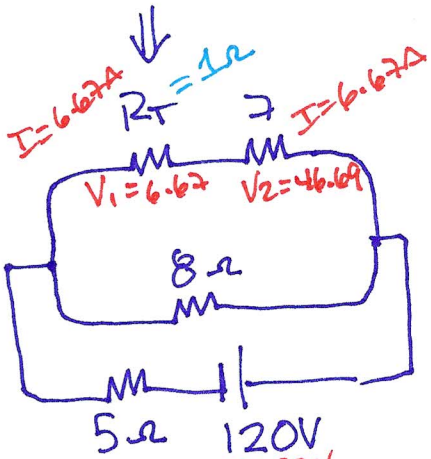
$$\frac{1}{R_{TP}} = \frac{6}{6}$$

$$R_{TP} = 1\,\Omega$$

$$I_1 = \frac{V}{R} = \frac{6.67}{6} = 1.11\,A$$

$$I_2 = \frac{V}{R} = \frac{6.67}{3} = 2.22\,A$$

$$I_3 = \frac{V}{R} = \frac{6.67}{2} = 3.34\,A$$




$$R_{TS} = 1 + 7$$

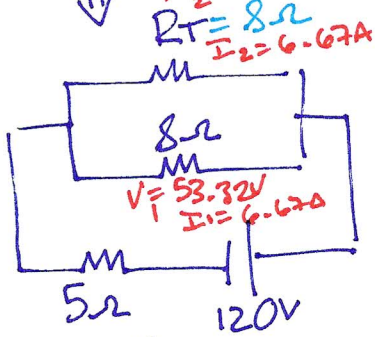
$$R_{TS} = 2\,\Omega$$

$$V_1 = I R_T = (6.67)(1)$$

$$V_1 = 6.67\,V$$

$$V_2 = IR = (6.67)(7)$$

$$V_2 = 46.69\,V$$



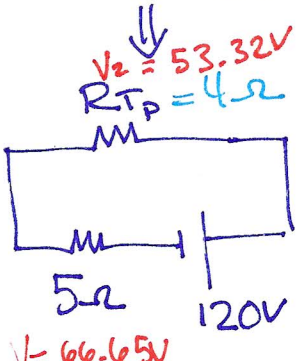

$$\frac{1}{R_{TP}} = \frac{1}{8} + \frac{1}{8}$$

$$\frac{1}{R_{TP}} = \frac{2}{8}$$

$$R_{TP} = \frac{8}{2} = 4\,\Omega$$

$$I_1 = \frac{V}{R_T} = \frac{53.32V}{8} = 6.67\,A$$

$$I_2 = \frac{V}{R_T} = \frac{53.32}{8} = 6.67\,A$$



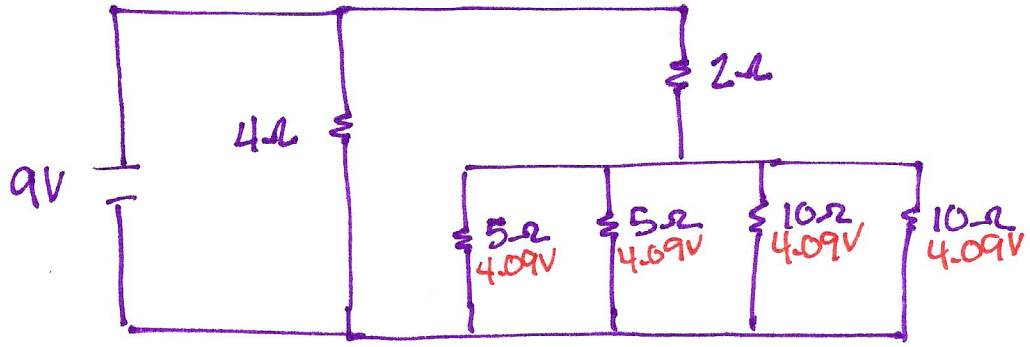

$$R_{TP} = 4 + 5 = 9\,\Omega$$

$$I = \frac{V}{R_T} = \frac{120}{9} = 13.33\,A$$

$$V_1 = (13.33)(5) = 66.65\,V$$

$$V_2 = (13.33)(4) = 53.32\,V$$

(3)

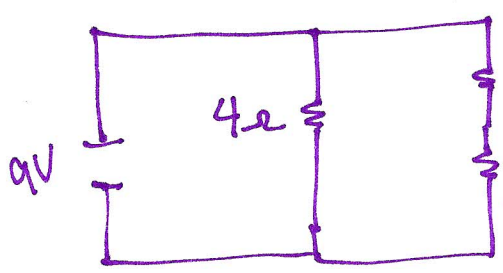



$I_3 = 4.09/5 = 0.82$
$I_4 = 4.09/5 = .82$
$I_5 = 4.09/10 = 0.41$
$I_6 = 4.09/10 = 0.41$

⇓ Simplify Parallel

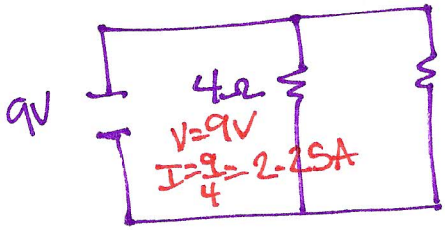
$\frac{1}{R_T} = \frac{1}{5} + \frac{1}{5} + \frac{1}{10} + \frac{1}{10}$

$R_T = 1.67\Omega$



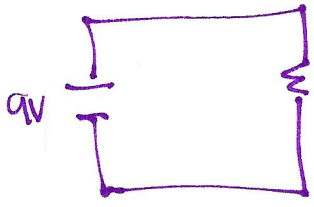

$I = 2.45A$
$V = 2(2.45) = 4.9V$
$RT_P = 1.67\Omega$
$I = 2.45A$
$V = 1.67(2.45) = 4.09V$

⇓ Simplify Series




$RT_S = 3.67\Omega$
$V = 9V$
$I = \frac{9}{3.67} = 2.45A$

⇓ Simplify Parallel




$RT_P = 1.91\Omega$

$I = \frac{V}{R_T} = \frac{9}{1.91} = 4.71A$