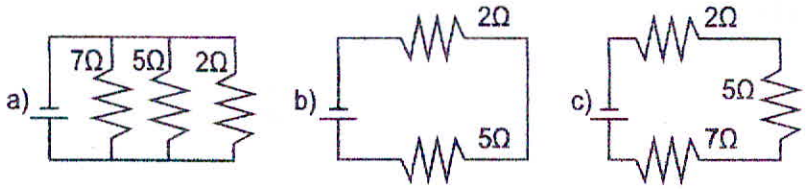
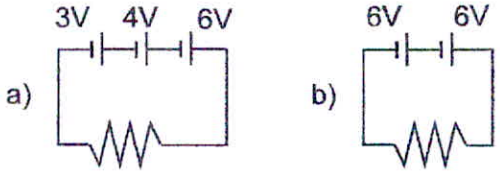
CIRCUITS WORKSHEET

1. Determine the equivalent (total) resistance for each of the following circuits below.

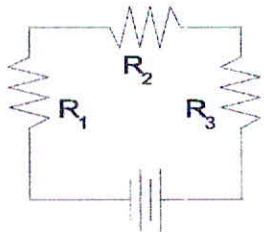


2. Determine the total voltage (electric potential) for each of the following circuits below.



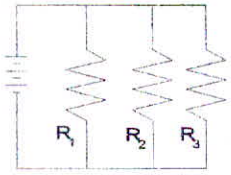
3. Fill out the table for the circuit diagramed at the right.

	R_1	R_2	R_3	TOTAL
V				6 V
I				
R	10	20	30	
P				



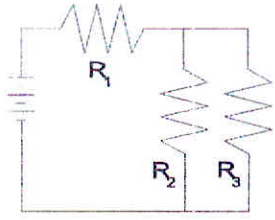
4. Fill out the table for the circuit diagramed at the right.

	R_1	R_2	R_3	TOTAL
V				60 V
I				
R	10	20	30	
P				

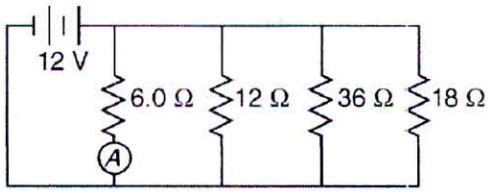


5. Fill out the table for the circuit diagramed at the right.

	R_1	R_2	R_3	TOTAL
V				6 V
I				
R	10 Ω	20 Ω	30 Ω	
P				



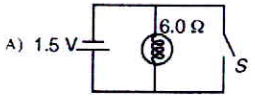
Questions 6 and 7 refer to the following:
The diagram to the right represents an electric circuit consisting of four resistors and a 12-volt battery.

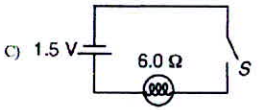


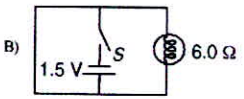
6) What is the equivalent resistance of the circuit shown?

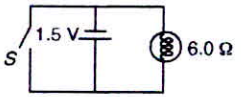
7) What is the current measured by ammeter A shown in the diagram?

8) A 6.0-ohm lamp requires 0.25 ampere of current to operate. In which circuit below would the lamp operate correctly when switch S is closed?

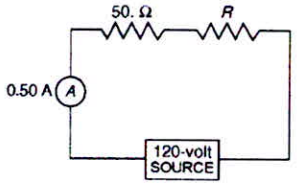
A) 

C) 

B) 

D) 

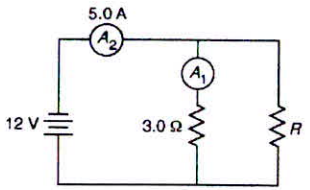
Questions 9 and 10 refer to the following:
A 50.-ohm resistor, an unknown resistor R, a 120-volt source, and an ammeter are connected in a complete circuit. The ammeter reads 0.50 ampere.



9) Calculate the equivalent resistance of the circuit shown.

10) Determine the resistance of resistor R shown in the diagram.

Questions 11 through 13 refer to the following:
A 3.0-ohm resistor, an unknown resistor, R, and two ammeters, A_1 and A_2, are connected as shown below with a 12-volt source. Ammeter A_2 reads a current of 5.0 amperes.



11) Determine the equivalent resistance of the circuit shown.

12) Calculate the current measured by ammeter A_1 in the diagram shown.

13) Calculate the resistance of the unknown resistor, R in the diagram shown.

14. The load across a 50.0-V battery consists of a series combination of two lamps with resistances of 125 Ω and 225 Ω.
   a. Find the total resistance of the circuit.
   b. Find the current in the circuit.
   c. Find the potential difference across the 125-Ω lamp.

15. The load across a 12-V battery consists of a series combination of three resistances are 15 Ω, 21 Ω, and 24 Ω, respectively.
   a. Draw the circuit diagram.
   b. What is the total resistance of the load?
   c. What is the magnitude of the circuit current?

16. The load across a 40-V battery consists of a series combination of three resistances R_1, R_2, and R_3. R_1 is 240 Ω and R_3 is 120 Ω. The potential difference across R_1 is 24 V.
   a. Find the current in the circuit.
   b. Find the equivalent resistance of the circuit.
   c. Find the resistance of R_2.

17. The load across a 12-V battery consists of a series combination of three resistances R_1, R_2, and R_3. R_1 is 210 Ω, R_2 is 350 Ω, and R_3 is 120 Ω.
   a. Find the equivalent resistance of the circuit.
   b. Find the current in the circuit.
   c. Find the potential difference across R_3.

18. Two resistances, one 12 Ω and the other 18 Ω, are connected in parallel. What is the equivalent resistance of the parallel combination?

19. Three resistances of 12 Ω each are connected in parallel. What is the equivalent resistance?

20. Two resistances, one 62 Ω and the other 88 Ω, are connected in parallel. The resistors are then connected to a 12-V battery.
   a. What is the equivalent resistance of the parallel combination?
   b. What is the current through each resistor?

21. A 110-V household circuit that contains an 1800-W microwave, a 1000-W toaster, and an 800-W coffeemaker is connected to a 20-A fuse. Determine the current. Will the fuse melt if the microwave and the coffeemaker are both on?

22. A 35-Ω, 55-Ω, and 85-Ω resistor are connected in parallel. The resistors are then connected to a 35-V battery.
   a. What is the equivalent resistance of the parallel combination?
   b. What is the current through each resistor?

23. Resistors R_1, R_2, and R_3 have resistances of 15.0 Ω, 9.0 Ω, and 8.0 Ω respectively. R_1 and R_2 are connected in series, and their combination is in parallel with R_3 to form a load across a 6.0-V battery.
   a. Draw the circuit diagram.
   b. What is the total resistance of the load?
   c. What is the current in R_3?
   d. What is the potential difference across R_2?

24. A 15.0-Ω resistor is connected in series to a 120-V generator and two 10.0-Ω resistors that are connected in parallel to each other.
   a. Draw the circuit diagram.
   b. What is the total resistance of the load?
   c. What is the magnitude of the circuit current?
   d. What is the current in one of the 10.0-Ω resistors?
   e. What is the potential difference across the 15.0-Ω resistor?

Answers

1a) 1.2 Ω	1b) 7 Ω	1c) 14 Ω
2a) 13 V	2b) 12 V	6) 3.0 Ω
7) 2.0 A	8) C	9) 240 Ω
10) 190 Ω	11) 2.4 Ω	12) 4.0 A
13) 12 Ω	14a) 350. Ω	14b) 0.143 A
14c) 17.9 V	15b) 60. Ω	15c) 0.20 A
16a) 0.10 A	16b) 400 Ω	16c) 40. Ω
17a) 680 Ω	17b) 0.018 A	17c) 2.2 V
18) 7.2 Ω	19) 4.0 Ω	20a) 36 Ω

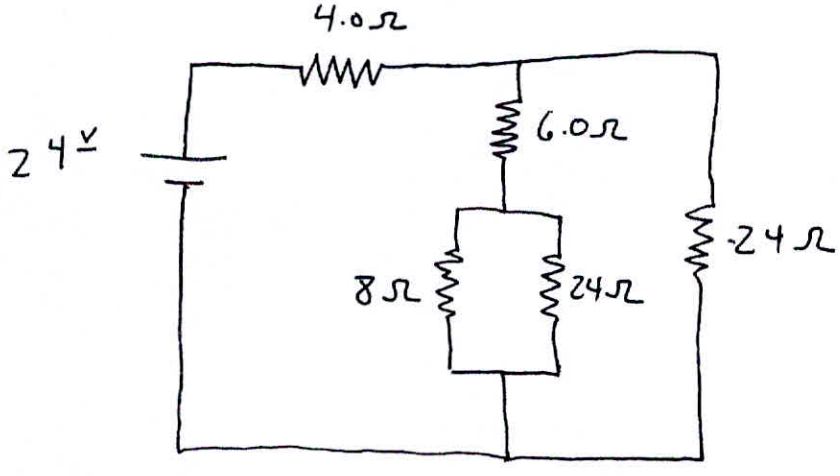
20b) $I_{62\Omega} = 0.19$ A; $I_{88\Omega} = 0.14$ A
21) I = 23.6 A so fuse will melt 22a) 17 Ω
22b) $I_{35\Omega} = 1.0$ A; $I_{55\Omega} = 0.64$ A; $I_{85\Omega} = 0.41$ A

23b) 6.0 Ω	23c) 0.75 A	23d) 2.3 V
24b) 20.0 Ω	24c) 6.0 A	24d) 3.0 A

24e) 90. V

Circuit Worksheet - Challenge Problems

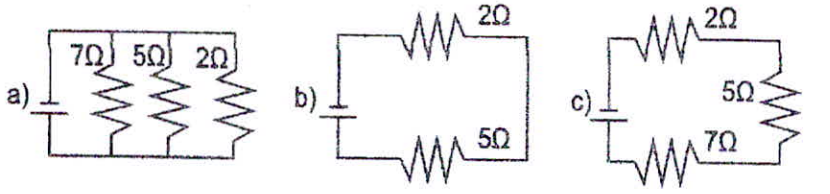
1. FIND the current and voltage for all components in the following circuit



2. 2 light bulbs are rated for 45W & 75W when located on a 120V electrical circuit IF the battery producing the 120V has an internal resistance of .2Ω. What is the current through the battery if the light bulbs are connected in series? or parallel?

CIRCUITS WORKSHEET

1. Determine the equivalent (total) resistance for each of the following circuits below.

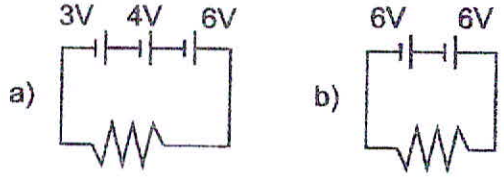


a. $\frac{1}{R_{eq}} = \frac{1}{7} + \frac{1}{5} + \frac{1}{2} = 1.18\,\Omega$

b. $R_{eq} = 2 + 5 = 7\,\Omega$

c. $R_{eq} = 2 + 5 + 7 = 14\,\Omega$

2. Determine the total voltage (electric potential) for each of the following circuits below.

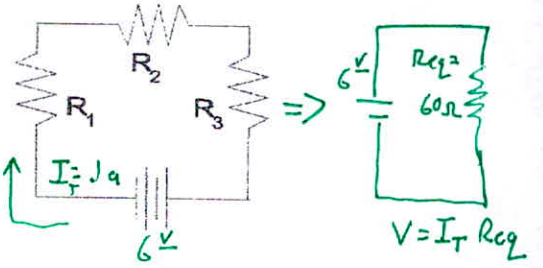


a. $3V + 4V + 6V = 13V$

2b. $6V + 6V = 12V$

3. Fill out the table for the circuit diagramed at the right.

	R_1	R_2	R_3	TOTAL
V	$1V$	$2V$	$3V$	$6V$
I	$.1A$	$.1A$	$.1A$	$.1A$
R	10	20	30	$60\,\Omega$
P	$.1W$	$.2W$	$.3W$	$.6W$



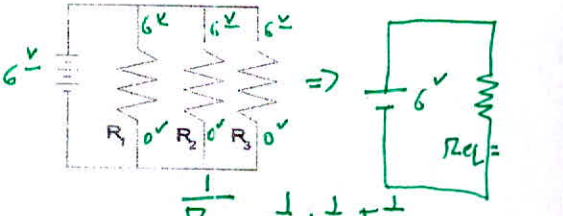
$V = I_T R_{eq}$

$I_T = \frac{6}{60} = .1A$

4. Fill out the table for the circuit diagramed at the right.

	R_1	R_2	R_3	TOTAL
V	$6V$	$6V$	$6V$	$6.0V$
I	$.6A$	$.3A$	$.2A$	$1.1A$
R	10	20	30	$5.45\,\Omega$
P	$3.6W$	$1.8W$	$1.2W$	$6.6W$

$I = \frac{V}{R}$



$\frac{1}{R_{eq}} = \frac{1}{10} + \frac{1}{20} + \frac{1}{30}$

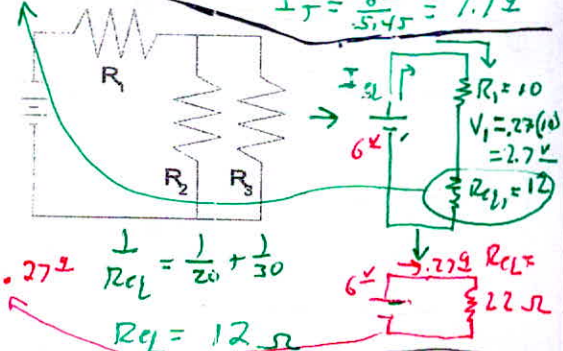
$R_{eq} = 5.45$

$I_T = \frac{6V}{5.45} = 1.1A$

5. Fill out the table for the circuit diagramed at the right.

	R_1	R_2	R_3	TOTAL
V	2.7	$3.24V$	3.24	$6V$
I	$.27$	$.162$	$.108$	$.27A$
R	$10\,\Omega$	$20\,\Omega$	$30\,\Omega$	$22\,\Omega$
P	$.73W$	$.52W$	$.34992$	$1.6W$

$V = .27(12)$

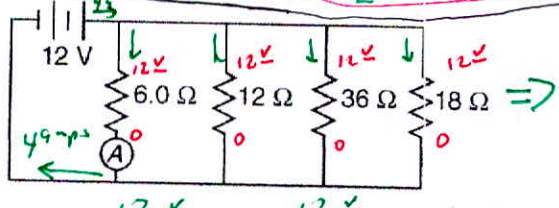


$\frac{1}{R_{eq}} = \frac{1}{20} + \frac{1}{30}$

$I_T = \frac{6V}{22\,\Omega} = .27A$

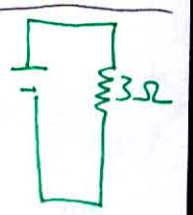
$R_{eq} = 12\,\Omega$

Questions 6 and 7 refer to the following
The diagram to the right represents an electric circuit consisting of four resistors and a 12-volt battery.



$\frac{1}{R_{eq}} = \frac{1}{6} + \frac{1}{12} + \frac{1}{36} + \frac{1}{18}$

$R_{eq} = 3\,\Omega$



$I_T = \frac{12V}{R_{eq}} = \frac{12V}{3} = 4\ \text{Amps}$

6) What is the equivalent resistance of the circuit shown? 3 Ω

7) What is the current measured by ammeter A shown in the diagram? 2.0 amps

	R 6.0 Ω
V	12 V
I	
R	6.0 Ω
P	

$I = \frac{12}{6} = 2$ A

8) A 6.0-ohm lamp requires 0.25 ampere of current to operate. In which circuit below would the lamp operate correctly when switch S is closed?

A) 1.5 V, 6.0 Ω, S — closing switch short across (R = 0) no current ⇒ 0 power

C) 1.5 V, 6.0 Ω, S — 1.5 V, 0

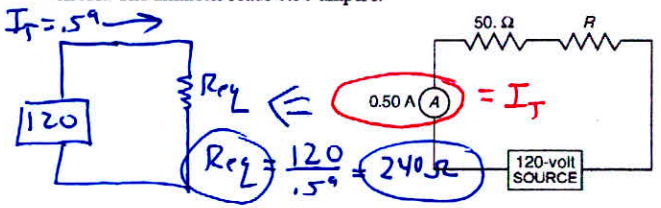
B) 1.5 V, S, 6.0 Ω — short again

D) S, 1.5 V, 0, 0, 1.5, 1.5, 6.0 Ω ← close switch wire no resistance no flow through light bulb ⇒ creates short!!

	6 Ω
V	1.5
I	–
R	6

$I = \frac{1.5}{6} = .25$

Questions 9 and 10 refer to the following:
A 50.-ohm resistor, an unknown resistor R, a 120-volt source, and an ammeter are connected in a complete circuit. The ammeter reads 0.50 ampere.



$R_{eq} = \frac{120}{.5} = 240\ \Omega$

So

	50 Ω	R	Total
V	? = 25 V	95 V	120 V
I	.5 A	.5 A	.5 A
R	50 Ω	190 Ω	240 Ω

$V_{50\Omega} = .5(50) = 25$ V

$R = \frac{95}{.5} = 190\ \Omega$

NOTE $V_{50} + V_R = 120$ V

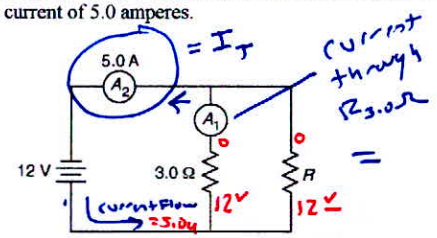
$25 + V_R = 120$

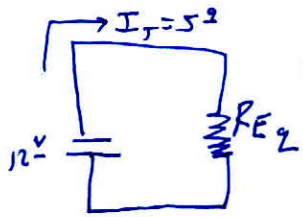
$V_R = 95$ V

9) Calculate the equivalent resistance of the circuit shown. 240 Ω

10) Determine the resistance of resistor R shown in the diagram. 190 Ω

Questions 11 through 13 refer to the following:
A 3.0-ohm resistor, an unknown resistor, R, and two ammeters, A_1 and A_2, are connected as shown below with a 12-volt source. Ammeter A_2 reads a current of 5.0 amperes.





$R_{eq} = \frac{12\text{ V}}{5\text{ A}} = 2.4\ \Omega$

	$R_{3\Omega}$	R	Total
V	12 V	12 V	12 V
I	4 A	+ 1 A	= 5 A
R	3 Ω	12 Ω	2.4 Ω

$I = \frac{12}{3} = 4$ A

11) Determine the equivalent resistance of the circuit shown. 2.4 Ω

12) Calculate the current measured by ammeter A_1 in the diagram shown. 4.0 A

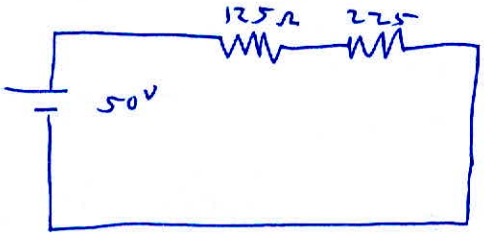
13) Calculate the resistance of the unknown resistor, R in the diagram shown. 4 Ω

$\frac{1}{R_{eq}} = \frac{1}{R_{3.0\Omega}} + \frac{1}{R}$

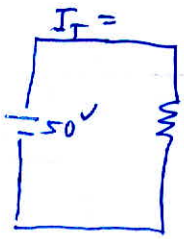
$\frac{1}{2.4\ \Omega} - \frac{1}{3.0\ \Omega} = \frac{1}{R}$

$R = 12\ \Omega$

#14



→



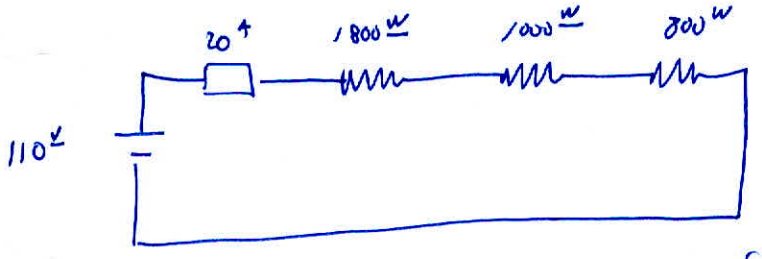
$I_T = \frac{50}{350} = .143^{a}$

	R_{125}	R_{225}	Total
V	17.9V		50
I	.143a		.143a
R	125	225	350Ω

#15 → #20 you do answers on sheet. Use equivalent circuit and VIPR Table!!

...

#21

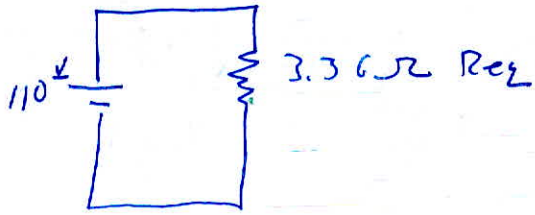


P for Circuit = $\frac{V^2}{R_{eq}}$

$3600^{W} = \frac{110^2}{R_{eq}}$

$R_{eq} = 3.36\Omega$

remember current is the same for all in a series resistor



	1800W	1000W	800W	TOTAL
V	55V	30.6V	24.4V	110V
I	32.7	32.7	32.7	32.7a
R				3.36Ω
P	1800W	1000W	800W	3600W

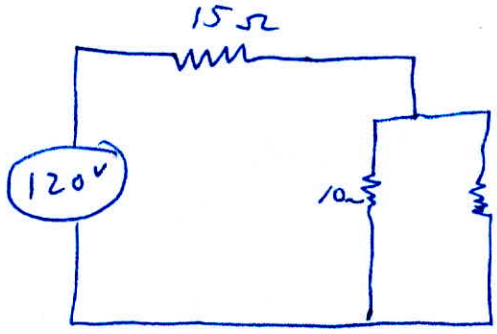
$I_T = \frac{V_T}{R_{eq}} = \frac{110}{3.36}$

$I_T = 32.7$ amps

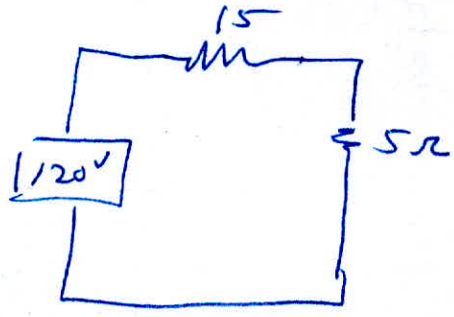
$I_T >$ amp breaks

NOTE: Answer on sheet is wrong.

#24.

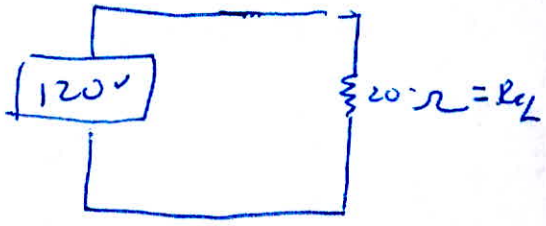


$\Rightarrow$



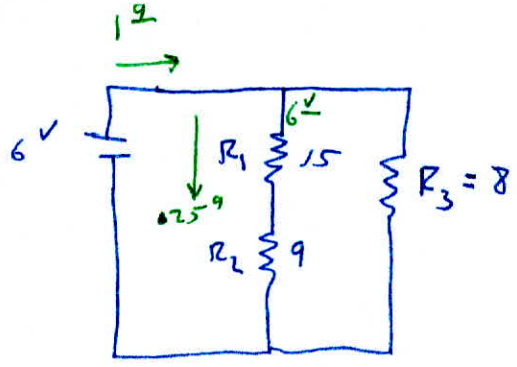
$\frac{1}{R_{eq}} = \frac{1}{10} + \frac{1}{10}$

$R_{eq} = 5\Omega$



	15	10Ω	10Ω	TOTAL
V				120
I				
R	15Ω	10Ω	10Ω	20Ω
P				

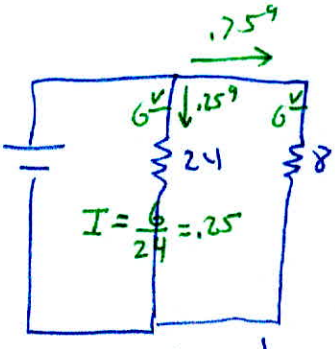
#23



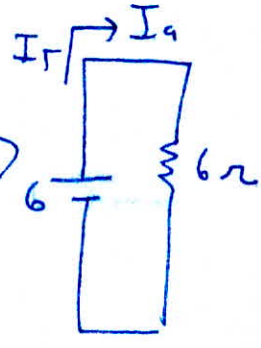
$V = IR$

$V = .25(15)$

$\Rightarrow$



$\Rightarrow$



$\frac{1}{24} + \frac{1}{8} =$

$R_{eq} = 6\Omega$

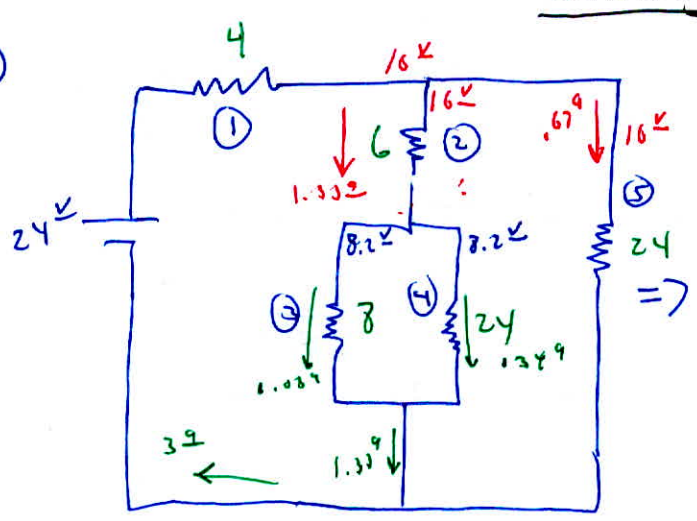
	15Ω	9Ω	8Ω	TOTAL
V	3.75V	2.25V	6V	6V
I	.25?	.25?	.75?	I?
R	15Ω	9Ω	8Ω	6Ω
P				

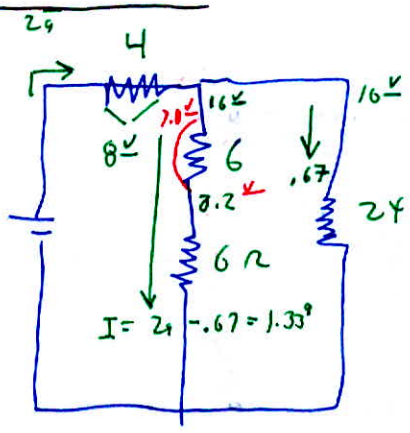
(a) (b) (c) (d)

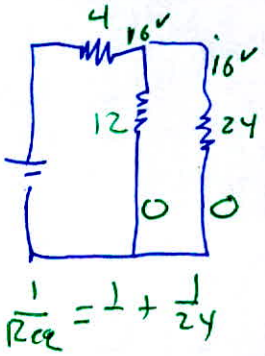
$I = \frac{6}{8} = .75$

Challenge Problems

(1)





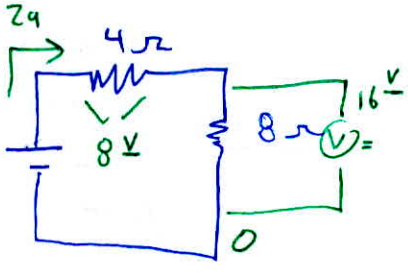


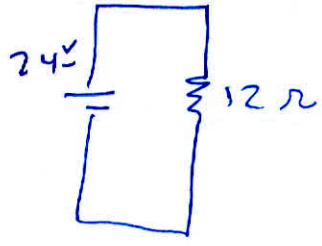
$\frac{1}{R_{eq}} = \frac{1}{24} + \frac{1}{24}$

$R_{eq} = 8\ \Omega$

$\frac{1}{R_{eq}} = \frac{1}{8} + \frac{1}{24} =$

$R_{eq} = 6\ \Omega$

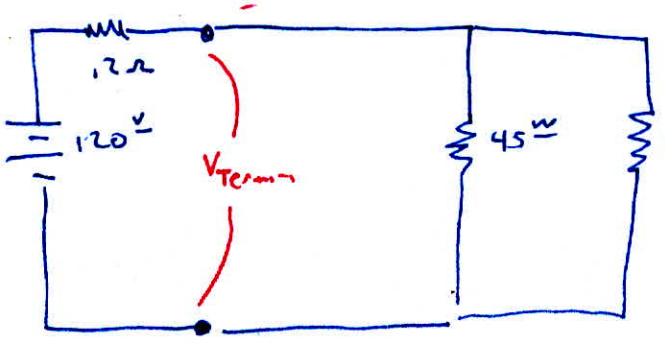




$I_T = \frac{24}{12} = 2\ A$

	1	2	3	4	5	Total
V	8 V	7.8 V	8.2 V	8.2 V	16 V	18 V
I	2 A	1.3 A	1.03 A	.34 A	.67 A	2 A
R	4 Ω	6 Ω	8 Ω	24 Ω	24 Ω	12 Ω
P						

(2)



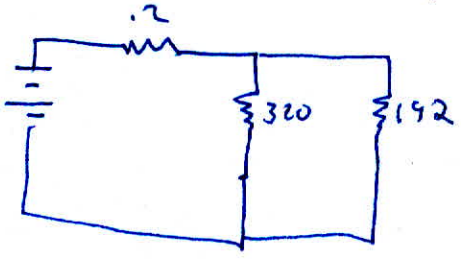
$75W = \frac{120^2}{R}$

$R = 192\Omega$

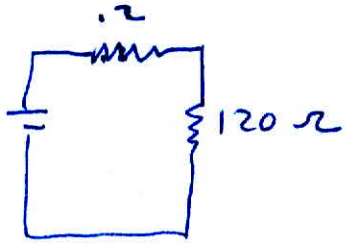
$45W = \frac{V^2}{R}$

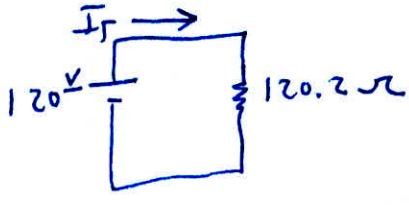
$R_1 = 320\Omega$

//



$\Rightarrow$

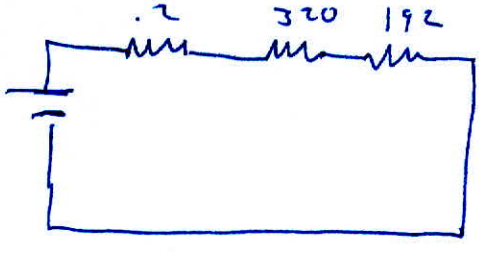


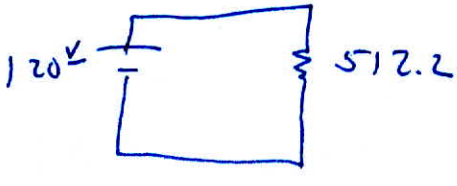


$I_T = \frac{120}{120.2} \angle .99^\circ$

$= 1A$

series





$V_T = .23^V$