Series & Parallel Circuits

	CONNECTED IN SERIES	CONNECTED IN PARALLEL
Voltage	$V_T = V_1 + V_2 + V_3 + \cdots$	$V_T = V_1 = V_2 = V_3 = \cdots$
Current	$I_T = I_1 = I_2 = I_3 = \cdots$	$I_T = I_1 + I_2 + I_3 + \cdots$
Resistance	$R_T = R_1 + R_2 + R_3 + \cdots$	$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots$
Power	$P_T = P_1 + P_2 + P_3 + \cdots$	$P_T = P_1 + P_2 + P_3 + \cdots$

Ohm's Law: $V = IR$ power: $P = VI = I^2R = \frac{V^2}{R}$

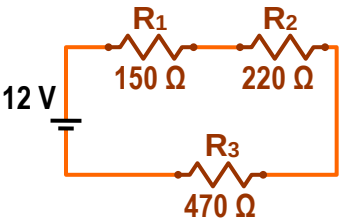
n identical resistors in <u>series</u>: $R_T = nR$

n identical resistors in <u>parallel</u>: $R_T = \frac{R}{n}$

short cut for 2 resistors in parallel: $R_T = \frac{R_1 R_2}{R_1 + R_2}$

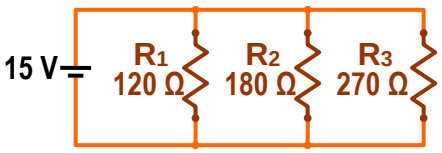
EXERCISES

A. Considering the following circuit, complete the table:



	R_1	R_2	R_3	R_{TOTAL}
Voltage (V)				12
Current (A)				
Resistance (Ω)	150	220	470	
Power (W)				

B. Considering the following circuit, complete the table:



	R_1	R_2	R_3	R_{TOTAL}
Voltage (V)				15
Current (A)				
Resistance (Ω)	120	180	270	
Power (W)				

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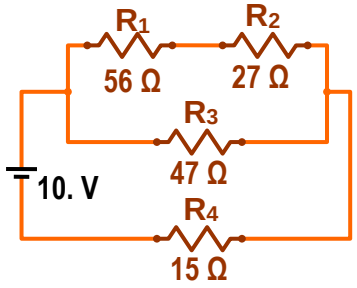
C. Considering the following circuit, complete the table:



	R_1	R_2	R_3	R_4	R_{TOTAL}
Voltage (V)					10
Current (A)					
Resistance (Ω)	56	27	47	15	
Power (W)					

D. Twenty resistors, each with a resistance of 22 Ω, are connected in series. What is the total resistance?

E. Ten resistors, each with a resistance of 1000 Ω, are connected in parallel. What is the total resistance?

F. Three resistors can be connected in a variety of ways to obtain eight different resistances. What resistances can be obtained with each of the following? [*Hint: First, figure out what four configurations there can be with three resistors.*]

1) 18 Ω, 56 Ω, 82 Ω

2) 220. Ω, 330. Ω, 470. Ω

SOLUTIONS

A.

	R_1	R_2	R_3	R_T
V	2.1	3.1	6.7	**12**
I	.014	.014	.014	.014
R	**150**	**220**	**470**	840
P	.031	.045	.096	.171

B.

	R_1	R_2	R_3	R_T
V	15	15	15	**15**
I	0.13	.083	.056	0.26
R	**120**	**180**	**270**	56.8
P	1.9	1.3	0.83	4.0

C.

	R_1	R_2	R_3	R_4	R_T
V	4.5	2.2	6.7	3.3	**10**
I	.080	.080	0.14	0.22	0.22
R	**56**	**27**	**47**	**15**	45
P	0.36	0.17	0.95	0.74	2.2

D. 440 Ω E. 100 Ω

F. (1) 12 Ω, 16 Ω, 36 Ω, 39 Ω, 51 Ω, 71 Ω, 96 Ω, 156 Ω
(2) 103 Ω, 173 Ω, 223 Ω, 253 Ω, 414 Ω, 480 Ω, 602 Ω, 1020 Ω