Electricity: Combined Circuits

Name: _____ Period: 8th Date: _____

Combined Circuits

A combined circuit is one where their components are series-connected in some parts and parallel in others. We won't be able to apply a *single* set of rules to every part of that circuit [as we did in series and parallel].

Instead, we will have to identify which parts of that circuit are series and which parts are parallel, and then selectively apply series and parallel rules as necessary to simplify it to one equivalent (total) resistance.

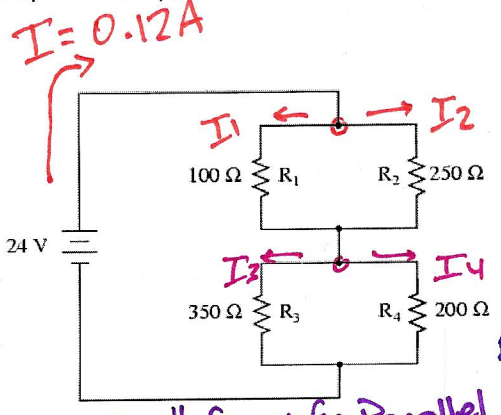
SERIES	PARALLEL
$V=V_1+V_2+V_3$	$V=V_1=V_2=V_3$
$I=I_1=I_2=I_3$	$I=I_1+I_2+I_3$
$R=R_1+R_2+R_3$	$\frac{1}{R_T}=\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}$

$V=IR$

$P=I^2R=IV$

$E=Pt$

Example 1: Complete the following table



Parallel R1 & R2

Parallel R3 & R4

	R_1	R_2	R_3	R_4	Total	
V	8.57	8.57	15.27	15.27	24	Volts
I	.086	.034	.044	.076	.12	Amps
R	100	250	350	200	198.7	Ohms

STEP 1: Simplify Parallel sub-circuits

R1 & R2: $\frac{1}{R_T}=\frac{1}{100}+\frac{1}{250}$ $\frac{1}{R_T}=\frac{5+2}{500}$ $\frac{1}{R_T}=\frac{7}{500}$ $R_T=\frac{500}{7}=71.43\Omega$

R3 & R4: $\frac{1}{R_T}=\frac{1}{350}+\frac{1}{200}$ $\frac{1}{R_T}=\frac{4+7}{1400}$ $\frac{1}{R_T}=\frac{11}{1400}$ $R_T=\frac{1400}{11}=127.27\Omega$

STEP 2: Simplify in Series ($R_{T1}+R_{T2}$)

$R_T=R_{T1}+R_{T2}=71.43\Omega+127.27\Omega$

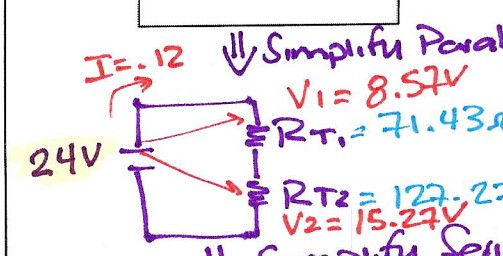
$R_T=198.7\Omega$

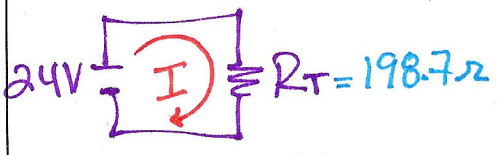
STEP 4: go back to Series & find V_1 & V_2 [I stays same]

$V_1=IR_{T1}=(.12A)(71.43)=8.57V$

$V_2=IR_{T2}=(.12A)(127.27)=15.27V$

≈ 24





STEP 3: Find current in circuit

$I=\frac{V}{R_T}=\frac{24V}{198.7}=0.12A$

STEP 5: Find current for each resistor

$I=\frac{V_1}{R_1}=\frac{8.57}{100}$ $I=0.086A$

$I=\frac{V_2}{R_2}=\frac{8.57}{250}$ $I=0.034A$

$I=\frac{V_3}{R_3}=\frac{15.27}{350}$ $I=0.044A$

$I=\frac{V_4}{R_4}=\frac{15.27}{200}$ $I=0.076A$

1. What is the overall current flowing in the circuit? 0.12

2. What is the current flowing through the R_4 resistor? 0.076

3. What is the Power dissipated on the R_1 resistor? 0.74W

$P=I_1V_1=(.086)(8.57)$

$P=0.74W$