1. A 60-V source is connected across a 30-k Ω resistance. (a) Draw the schematic diagram. (b) How much current flows through the resistance? (c) How much current flows through the voltage source? (d) If the resistance is doubled, how much is the current in the circuit?

2. A 12-V battery is connected across a 2- Ω resistance. (a) Draw the schematic diagram. (b) Calculate the power dissipated in the resistance. (c) How much power is supplied by the battery? (d) If the resistance is doubled, how much is the power?

3. A picture-tube heater has 800 mA of current with 6.3 V applied. (a) Draw the schematic diagram, showing the heater as a resistance. (b) How much is the resistance of the heater?

4. Convert the following units, using powers of 10 where necessary: (a) 12 mA to amperes; (b) 5000 V to kilovolts; (c) ½ MΩ to ohms; (d) 100,000 Ω to megohms; (e) ½ A to milliamperes; (f) 9000 microS to siemens; (g) 1000 microamps to milliamperes; (h) 5 kΩ to ohms; (i) 8 nanoseconds (ns) to seconds.

5. A current of 2 A flows through a 6- resistance connected across a battery. (a) How much is the applied voltage of the battery? (b) Calculate the power dissipated in the resistance. (c) How much power is supplied by the battery?

6. (a) How much resistance allows 30 A current with 6 V applied? (b) How much resistance allows 1 mA current with 10 kV applied? Why is it possible to have less current in (b) with the higher applied voltage?

7. A source of applied voltage produces 1 mA through a 10-M Ω resistance. How much is the applied voltage?

8. Calculate the current *1*, in ampere units, for the following examples: (a) *45* V applied across 68 kΩ (b) 250 V across 12 MΩ (c) 1200 W dissipated in 600 Ω

9. Calculate the *JR* voltage for the following examples: (a) 68 microA through 22 MΩ; (b) 2.3 mA through 47 kΩ; (c) 237 A through 0.012 Ω .

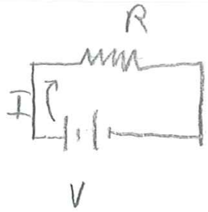
10. Calculate the resistance *R*, in ohms, for the following examples: (a) 134 mA produced by 220 V; (b) 800 W dissipated with 120 V applied; (c) a conductance of 9000 *microS*.

$P = UI$

$P = I^2R$

$P = \frac{V^2}{R}$

$P = UI$



$V = I \cdot R$

voltage = current · resistance

volts = amps · ohms

Brandon Buchanan
Anfora

V / I R

1. b $I = \frac{V}{R}$ $I = \frac{60}{30000}$ $I = 0.002$ a 2 ma
   c 2 ma
   d 1 ma
2. b $P = \frac{V^2}{R}$ $P = \frac{12^2}{2}$ $P = \frac{144}{2}$ $P = 72$ w
   c $P = 72$ w
   d $P = 36$ w
3. b $R = \frac{V}{I}$ $R = \frac{6300}{800}$ $R = 7.875\ \Omega$
4. a 0.012 a
   b 5 KV
   c 500,000
   d 0.1 megohms Ω
   e 500 ma
   f 0.009 s
   g 1 ma
   h 5,000,000 Ω
   i 0.000000008 s
5. a 12 V
   b $P = \frac{V^2}{R}$ $P = \frac{144}{6}$ $P = 24$ w
   c $P = 24$ w
6. a $R = \frac{V}{I}$ $R = \frac{6}{30}$ $R = \frac{1}{5}\ \Omega$
   b 10,000,000 Ω
7. $V = IR$ $V = 0.001(10,000,000)$ $V = 10,000$ V
8. a $I = \frac{V}{R}$ $I = \frac{45}{68000}$ $I = 6.62 \cdot 10^{-4}$ a
   b $I = \frac{V}{R}$ $I = \frac{250}{12000000}$ $I = 2.08\overline{3} \cdot 10^{-5}$ a
   c $P = I^2R$ $I = \pm\sqrt{\frac{P}{R}}$ $I = \pm\sqrt{\frac{1200w}{600\Omega}}$ $I = \pm\sqrt{2}$ a
   $I = 1.414$ a

tera
giga
Mega
kilo

milli
micro
nano
pico

$V = IR$
$P = VI$

9\. a $V = IR$ $V = 0.000068(22000000)$ $V = 1496\ V$

b $V = IR$ $V = 0.0023(47000)$ $V = 108.1\ V$

c $V = IR$ $V = 237(0.012)$ $V = 2.844\ V$

10\. a $R = \frac{V}{I}$ $R = \frac{220}{0.134}$ $R = 1641.79\ \Omega$

b $I = \frac{P}{V}$ $I = \frac{800}{120}$ $I = 6.\bar{6}\ \Omega$

c $1/4000\ \Omega$

V=IR

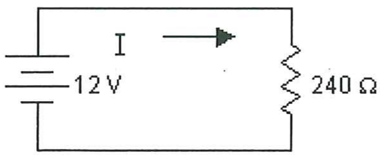
Ohm's Law
SHOW ALL WORK

ComTech

Name Brandon Buchanan

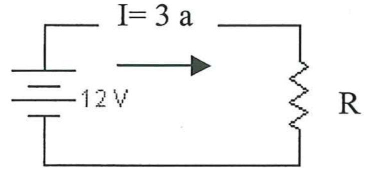
1. Find the current.

0.05a



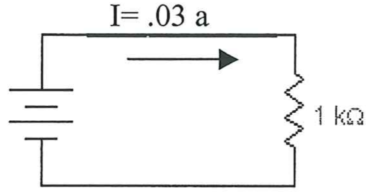
2. Find the Resistance

4 Ω

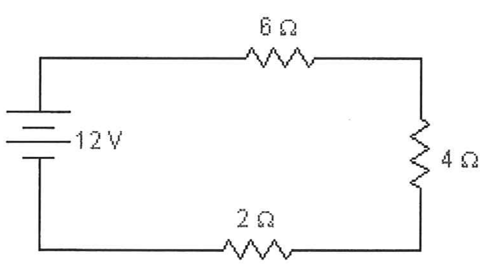


3. Find the voltage applied.

30 V



4. Find the total resistance, the current in the circuit and the voltage drop across each resistor.

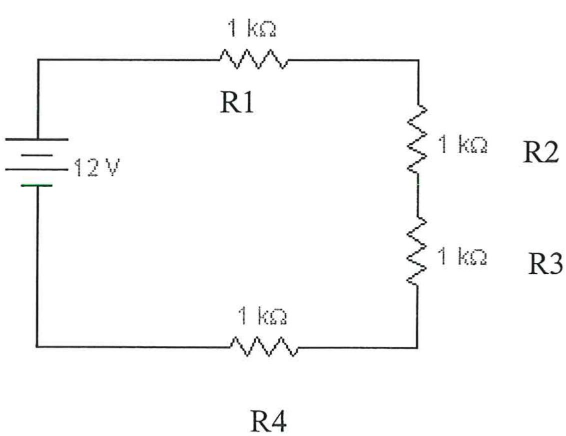


R_T = 12 Ω

I_T = 1 a

V_6 = 6 V
V_4 = 4 V
V_2 = 2 V

5. Find the total resistance, the current in the circuit and the voltage drop across each resistor.



R_T = 4000 Ω

I_T = 0.003 a

V_1 = 9 V
V_2 = 6 V
V_3 = 3 V
V_4 = 0 V

Brandon Buchanan
8.13.04

1. $I_1 = \frac{V_T}{R_1}$ $I_1 = \frac{25}{500}$ $I_1 = 0.05a$ $I_2 = 0.05a$
$I_T = 0.1a$

2. $I_1 = 1.33a$ $I_2 = 0.66a$ $I_3 = 0.33a$ $I_T = 2.33a$

3. $V_T = 2000V$ $I_T = 8a$

4. $V_T = 120V$ $I_2 = 2a$ $I_3 = 1a$ $I_T = 7a$

5. $V_1 = 1000V$ $R_2 = 250\Omega$

6. $V_T = 80V$ $R_3 = 18.46\Omega$

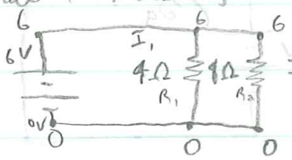
$V = IR$

$P = VI$

* series circuit - 1 Path and only one path for current

- current is same everywhere

* parallel circuits -



$I_T = I_1 + I_2$

$I_T = \frac{V_T}{R_T} = \frac{V_1}{R_1} + \frac{V_2}{R_2}$

$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$

$R_T = 2\frac{2}{3}\ \Omega$ $\qquad \frac{1}{R_T} = \frac{1}{4\Omega} + \frac{1}{8\Omega} \qquad \frac{1}{R_T} = \frac{2}{8} + \frac{1}{8}$

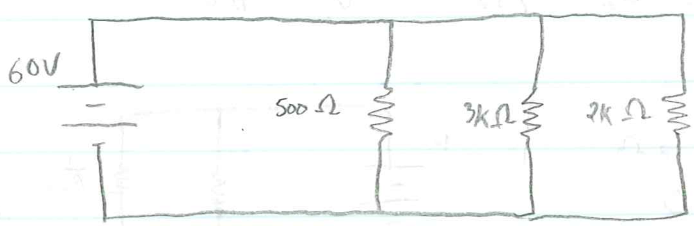
$I_T = \frac{V_T}{R_T} \qquad I_T = \frac{6V}{8/3\,\Omega} \quad \frac{18V}{8\Omega}$

$I_T = 2.25$ a

$I_1 = \frac{V_1}{R_1} \qquad I_1 = \frac{6V}{4\Omega} \qquad I_1 = 1.5$ a

$I_2 = I_T - I_1 \qquad I_2 = 0.75$ a

-



$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \qquad \frac{1}{R_T} = \frac{1}{500} + \frac{1}{3000} + \frac{1}{2000}$

$\frac{1}{R_T} = \frac{12}{6000} + \frac{2}{6000} + \frac{3}{6000} \qquad \frac{1}{R_T} = \frac{17}{6000} \qquad R_T = \frac{6000}{17} \qquad R_T = 352\,\Omega$

$I_T = \frac{V_T}{R_T} \qquad I_T = \frac{60V}{352\Omega} \qquad I_T = 0.17$ a

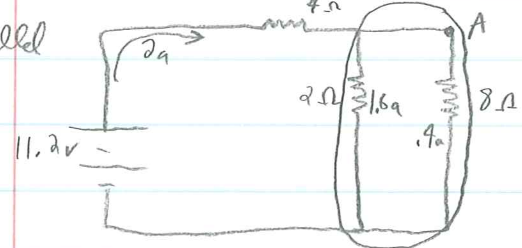
$I_1 = \frac{V_1}{R_1} \qquad I_1 = \frac{60V}{500\Omega} \qquad I_1 = 0.12$ a

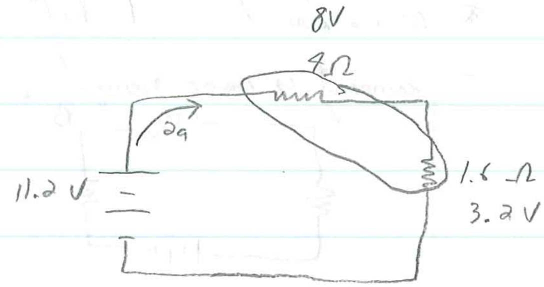
$I_2 = \frac{V_2}{R_2} \qquad I_2 = \frac{60V}{3000\Omega} \qquad I_2 = 0.02$ a

$I_3 = \frac{V_3}{R_3} \qquad I_3 = \frac{60V}{2000\Omega} \qquad I_3 = 0.03$ a

* combination circuit –

parallel



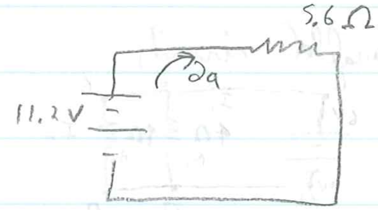


$\frac{1}{R_{2,3}} = \frac{1}{R_2} + \frac{1}{R_3}$

$\frac{1}{R_{2,3}} = \frac{1}{2\Omega} + \frac{1}{8\Omega}$

$\frac{1}{R_{2,3}} = \frac{5}{8\Omega}$

$R_{2,3} = 1.6\,\Omega$



$\frac{1}{R_{1,2,3}} = \frac{1}{R_1} + \frac{1}{R_{2,3}}$

$\frac{1}{R_{123}} = 4\,\Omega + 1.6\,\Omega$

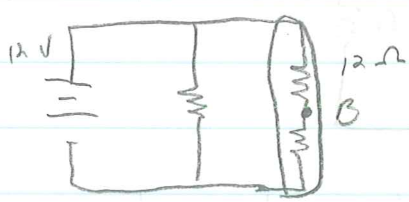
$\frac{1}{R_T} = 5.6\,\Omega$

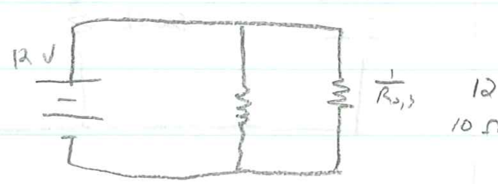
$I_T = \frac{V_T}{R_T}$

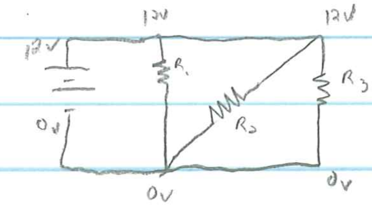
$I_T = \frac{11.2V}{5.6\,\Omega}$ $\quad I_T = 2a$

$V_1 = \frac{I_1}{R_1}$ $\quad V_1 = 2a \cdot 4\Omega$ $\quad V_1 = 8V$

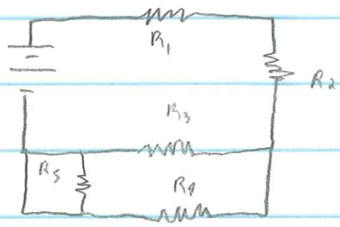
$I_2 = \frac{V_2}{R_2}$



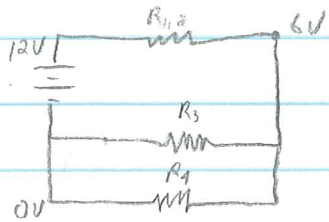




parallel circuit



R_1 + R_2 = series



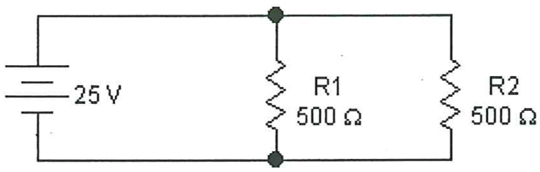
R_5 = dont need it

voltage is same

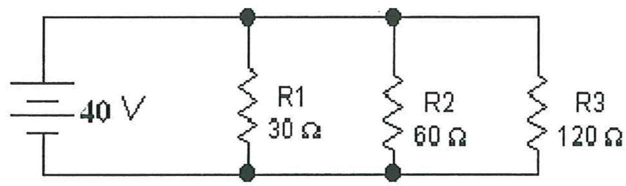
ITI   Parallel Circuits   Name Brandon Buchanan

SHOW ALL WORK

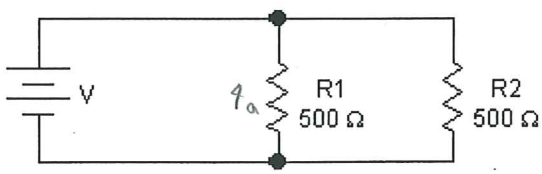
1. Find I_T, I_1, & I_2



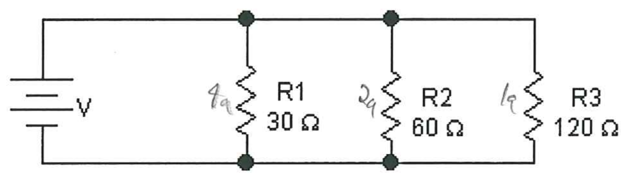
2. Find I_T, I_1, I_2, & I_3



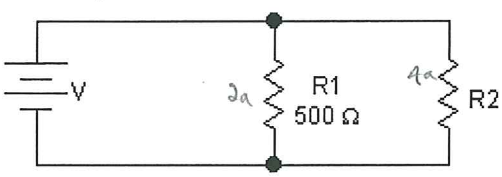
3. If I_1 = 4a, Find V and I_T



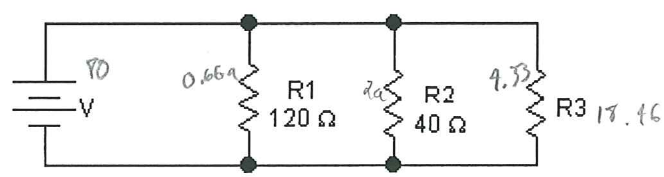
4. If I_1 = 4a, Find V, I_T, I_2, & I_3



5. If I_T =6a and I_1 = 2a, find V & R2



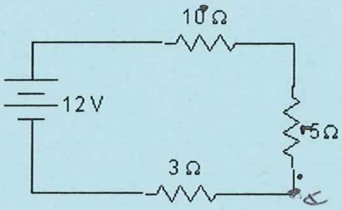
6. If I_T =7a and I_2 = 2a, find V & R3



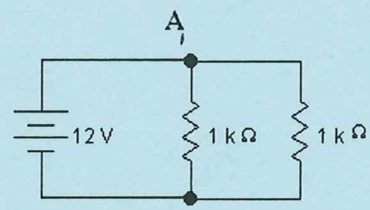
ComTech 2 Series & parallel Circuits Name Brandon Buchanan

$R_T = 18\Omega$
$I_T = 2/3$ a

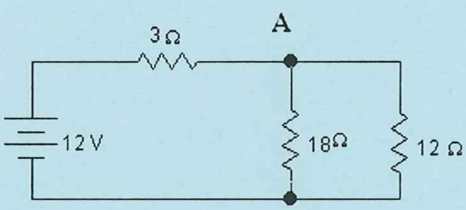
1.



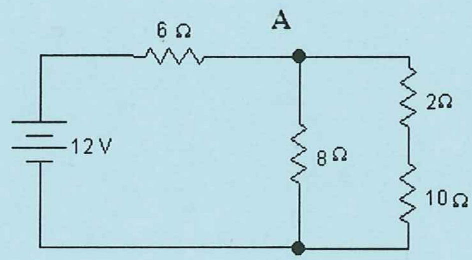
2.



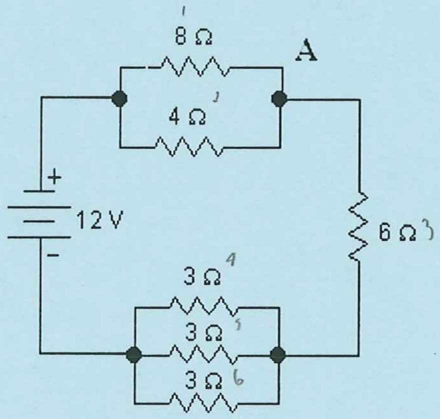
3.



4.



5.



*Find the **total resistance** and **total current** for each of the above circuits and the **voltage at point A**.*

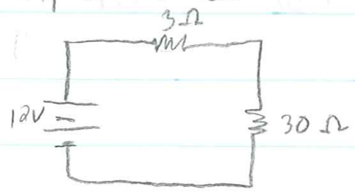
Steganos
PHLAK
Cain + Abel

Brandon Buchanan

1. $R_T = 18\Omega$ $I_T = 2/3\,a$

2. $R_T = 2000\Omega$ $I_T = 0.024\,a$

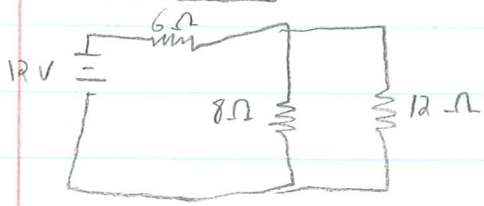
? 3.

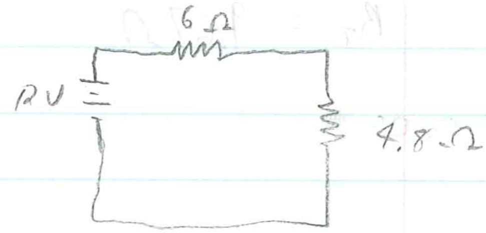


$R_T = 33\Omega$ $I_T = 0.36$

$V_A = 1.08V$

4.

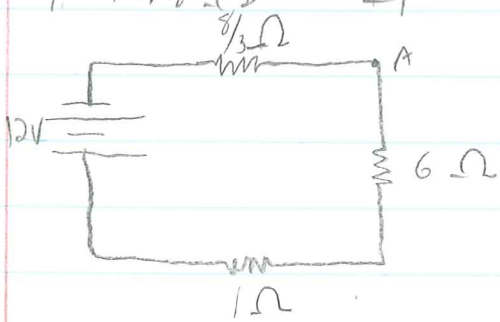




$\frac{1}{R_T} = \frac{1}{8} + \frac{1}{12}$ $\frac{1}{R_T} = \frac{3}{24} + \frac{2}{24}$ $\frac{1}{R_T} = \frac{5}{24}$ $R_{2,3} = 4.8\Omega$

$R_T = 10.8\,\Omega$ $I_T = \frac{10}{9}\,a$ $V_A = ~~6\frac{2}{3}~~\,V$ $5.4\,V$

5.



$R_T = 9\frac{2}{3}\,\Omega$

$I_T = 1.24\,a$

$V_A = 8.7\,V$

5. $\frac{1}{R_{1,2}} = \frac{1}{4\Omega} + \frac{1}{8\Omega}$ $\frac{1}{R_{1,2}} = \frac{8}{3}\Omega$

$\frac{1}{R_{4,5,6}} = \frac{1}{R_4} + \frac{1}{R_5} + \frac{1}{R_6}$ $\frac{1}{R_{4,5,6}} = \frac{1}{3\Omega} + \frac{1}{3\Omega} + \frac{1}{3\Omega}$

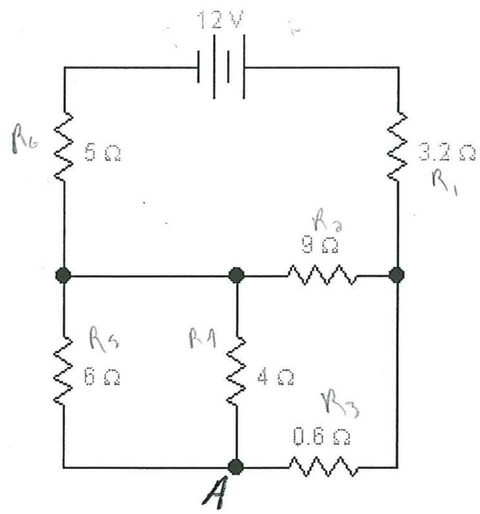
$\frac{1}{R_{4,5,6}} = \frac{3}{3\Omega}$ $\frac{1}{R_{4,5,6}} = 1\Omega$

$R_T = R_{1,2} + R_3 + R_{4,5,6}$

$R_T = 9.67\Omega$

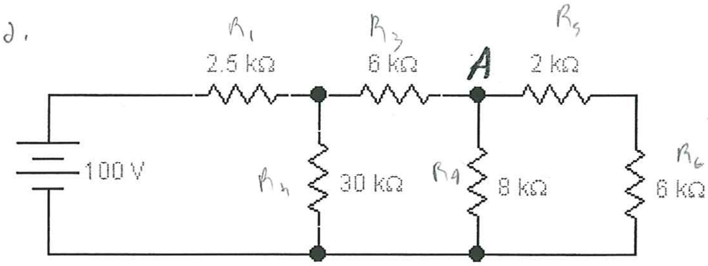
Comp Arch Series & Parallel 2

1.

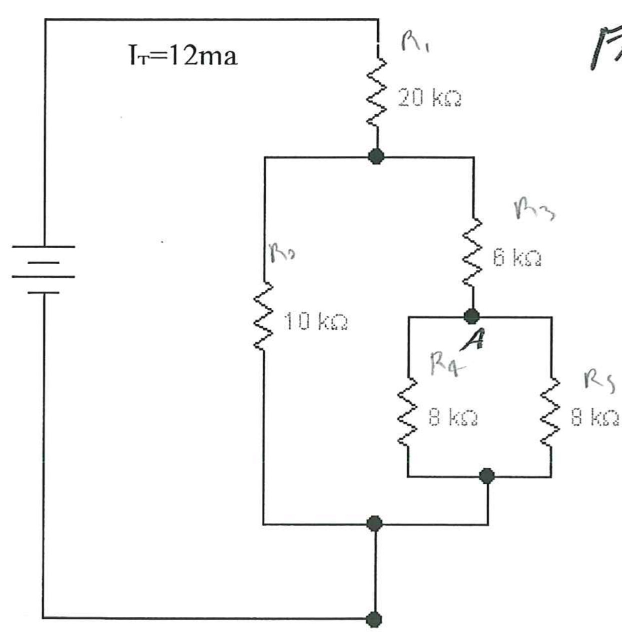


FIND R_T & V_A

2.



3.

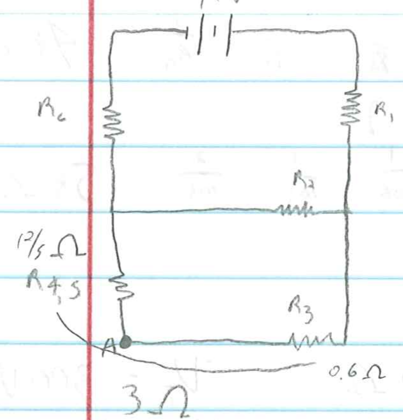


FIND V_T & V_A

Japan 4

Brandon Buchanan

1.

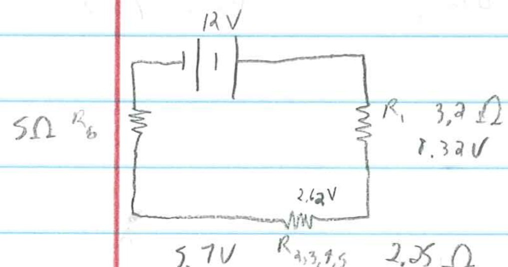


$\frac{1}{R_{4,5}} = \frac{1}{6} + \frac{1}{4}$ $\frac{1}{R_{4,5}} = \frac{2}{12} + \frac{3}{12}$ $\frac{1}{R_{4,5}} = \frac{5}{12}\,\Omega$

$R_{4,5} = \frac{12}{5}\,\Omega$

$\frac{1}{R_{3,4,5}} = 0.6\,\Omega + 2.4\,\Omega$ $\frac{1}{R_{3,4,5}} = 3\,\Omega$

$\frac{1}{R_{2,3,4,5}} = \frac{1}{9\,\Omega} + \frac{1}{3\,\Omega} = \frac{4}{9}\,\Omega$ $\frac{9}{4}\,\Omega$ $2.25\,\Omega$

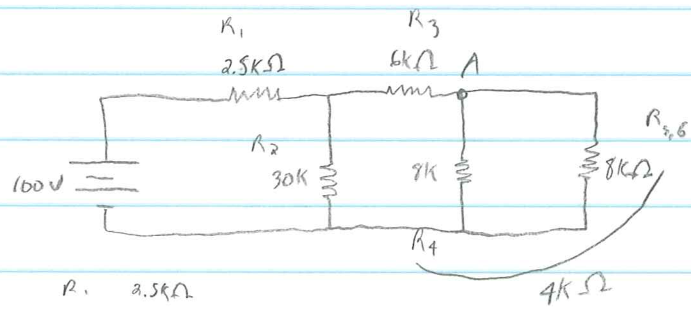


$R_T = 10.45\,\Omega$

$I_T = 1.15\,a$

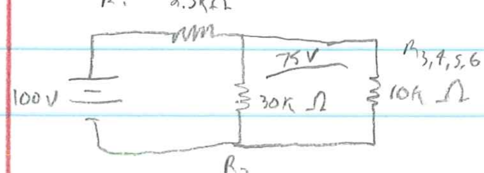
~~$V_A = 5.7\,V$~~ 7.8 V

2.



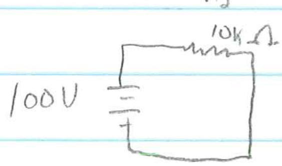
$R_{4,5,6} = \frac{1}{8k} + \frac{1}{8k} = \frac{2}{8k} = 4k$

$R_{3,4,5,6} = 10k\,\Omega$



$R_{2,3,4,5,6} = \frac{1}{30k} + \frac{1}{10k}$

$\frac{1}{30k} + \frac{3}{30k} = \frac{4}{30k} = \frac{30k}{4}$



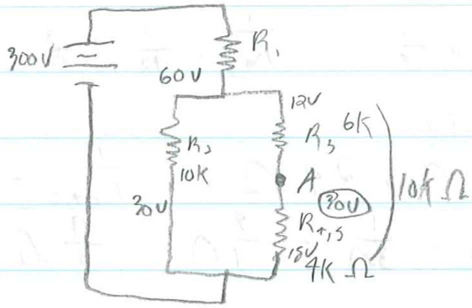
$R_{2,3,4,5,6} = 7.5k\,\Omega$

$R_T = 10k\,\Omega$

$I_T = 0.01\,a$

$V_A = 20V$

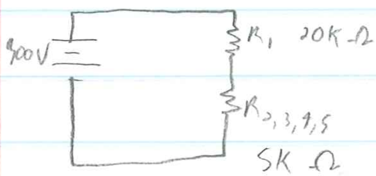
3.



$R_{4,5} = \frac{1}{8k} + \frac{1}{8k} = \frac{2}{8k} = \frac{1}{4k} = 4k\,\Omega$

$R_{3,4,5} = 10k\,\Omega$

$R_{2,3,4,5} = \frac{1}{10k} + \frac{1}{10k} = \frac{2}{10k} = 5k\,\Omega$

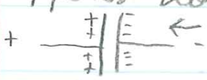


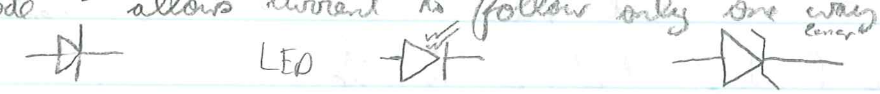
$R_T = 25000\,\Omega$ $V_T = 300\,V$

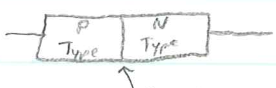
$I_T = 0.012\,a$ $V_A = 48\,V$

Brandon Buchanan

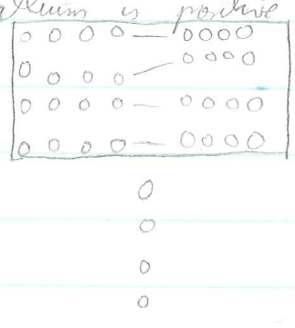
* * Impedance
  - opposes current changes
* Capacitors ⊣⊢ (measured in farads
  - opposes slow changes (allows faster changes) opposes DC



* Inductors (measured in Henrys)
  - oppose fast changes (allows slow changes) opposes AC
  - analog is AC
  - stores energy in magnetic field
  -  iron core inductor
  - ↗ means variable
* Modifies Current Flow (semiconductors)
  - diodo - allows current to follow only one way
  - 

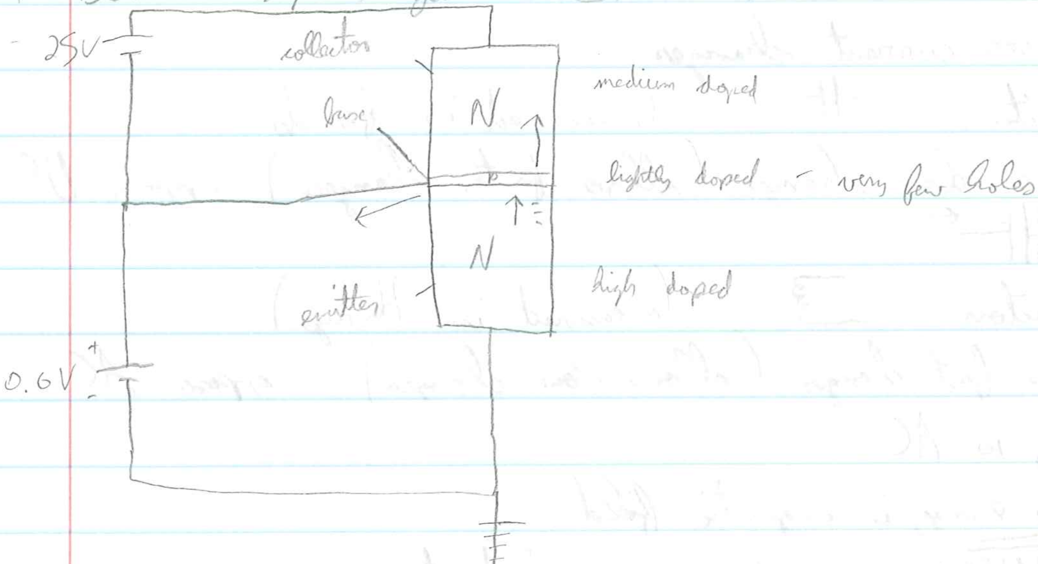
  - 

  - BJT - bipolar junction transistor
  - Gallium is positive and Arsenic is negative



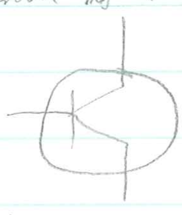
junction voltage is 7/10 V

* BJT - Bipolar Junction Transistor



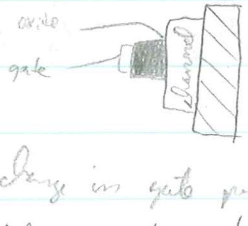
1/10 V

- a transistor act as a voltage amplifier
- FET - field effect transistor
- MOS - metal oxide silicon   CMOS - complimentary ...
- anode is P side   cathode is N side
-



BJT

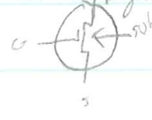
- MOSFET - metal oxide silicon field effect transistor



* a negative charge in gate pushes away

* 0 a flows in the gate

*



N Type

P Type

* normally off & normally on

* N Type depletion mode and enhanced mode

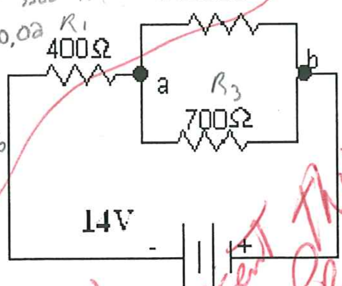
Brandon Buchanan

Comp tech Combo Circuits (Resistors)

(All work must be shown for credit) 6 pts ea.

80

1. For this figure, find:
   - The total resistance of the circuit 691 2/3 Ω
   - The total current in the circuit 0.02 a
   - The voltage at pt a 6 V



$\frac{1}{R_{23}} = \frac{1}{R_2} + \frac{1}{R_3} = \frac{1}{500} + \frac{1}{700} =$

$\frac{7}{3500} + \frac{5}{3500} = \frac{12}{3500} = \frac{3500}{12} = 291\frac{2}{3}$

$I_T = \frac{V_T}{R_T}$: $I_T = 0.02$

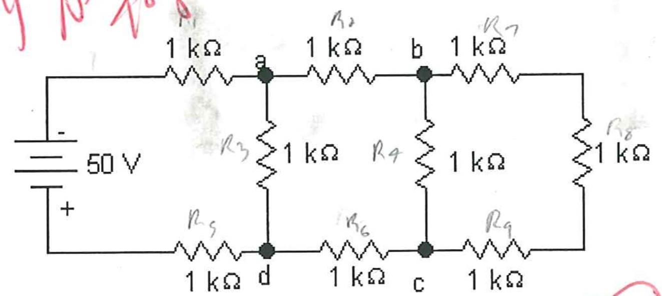
$R_1 \cdot I_T = V_1$ $400 \cdot 0.02 = 8V$

$V_A = V_T - V_1$: $V_A = 14 - 8 = 6$

You need to present this properly

2. For this figure, find:
   - The total resistance 2733 1/3 Ω
   - The total Current 0.018 a
   - The current in 1st vertical resistor(a-d) 0.009
   - The voltage at pt a 32V

-6

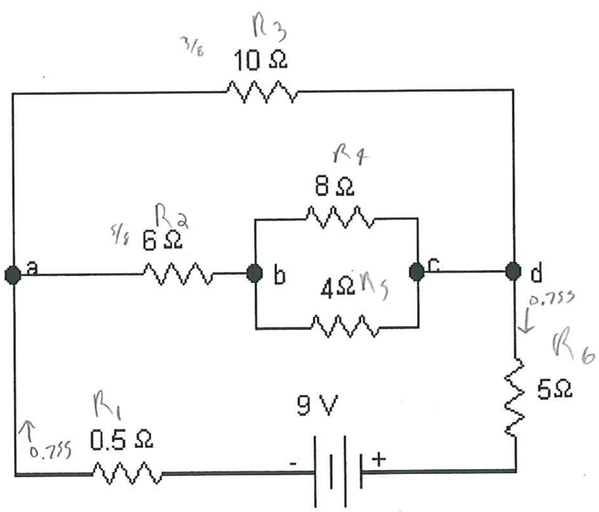


$I_T = \frac{V_T}{R_T}$: $I_T = \frac{50}{2733 1/3}$

$I_T = 0.018a$

3. For this figure, find:
   - The total resistance 11.917 Ω
   - The total current 0.755 Ω
   - The current in the 4Ω 0.189
   - Voltage at pt d 4.118 V

-6 -6 -2



4. For below, find:
   - R_T = 12 Ω
   - I_T = 1 a

Sloppy

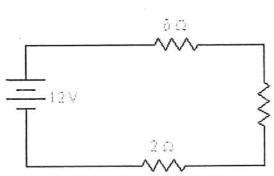
$R_T = 6 + 4 + 2$

$R_T = 12$

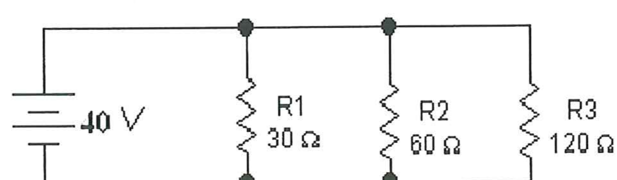
$I_T = \frac{V_T}{R_T}$

$I_T = \frac{12}{12}$

$I_T = 1$



5. For below find:
   - R_T = 17.143 Ω
   - I_T = 2.333 a

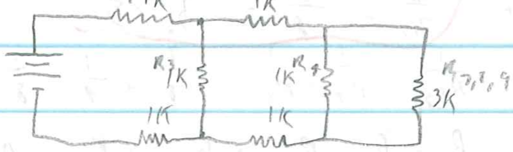


$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$ $\frac{1}{R_T} = \frac{1}{30} + \frac{1}{60} + \frac{1}{120}$

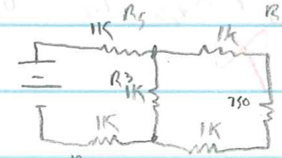
$\frac{4}{120} + \frac{2}{120} + \frac{1}{120}$ $\frac{7}{120} = \frac{120}{7} = 17.143\,\Omega$

$I_T = \frac{V_T}{R_T}$ $I_T = \frac{40}{17.143} = 2.333$

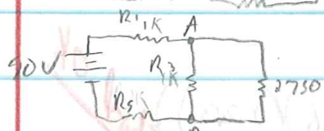
2. $R_{789} = R_7 + R_8 + R_9$ $\qquad R_{7,8,9} = 1k + 1k + 1k = 3k$



$\frac{1}{R_{4,7,8,9}} = \frac{1}{1000} + \frac{1}{3000} = \frac{4}{3000} = \frac{3000}{4} = 750\,\Omega$

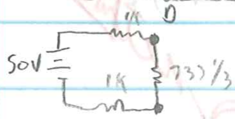


$R_{2,4,6,7,8,9} = 1k + 1k + 750 = 2750\,\Omega$



$\frac{1}{R_{2,3,4,6,7,8,9}} = \frac{1}{R_3} + \frac{1}{R_{2,4,6,7,8,9}} = \frac{1}{1000} + \frac{1}{2750} = \frac{11}{11000} + \frac{4}{11000} = \frac{15}{11000} =$

$\frac{11000}{15} = 733\frac{1}{3}\,\Omega$

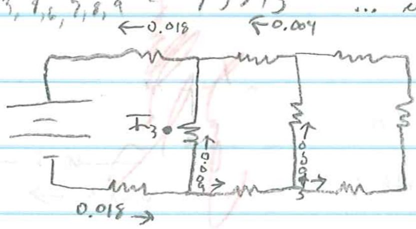


$R_T = R_1 + R_5 + R_{2,3,4,6,7,8,9} = 1k + 1k + 733\frac{1}{3} = 2733\frac{1}{3}$

* $V_D = V_T - (R_5(I_T))$ $\qquad V_D = 50V - (1k(0.18))$ $\qquad V_D = 50V - 18$ $\qquad V_D = 32$

$V_A = V_D - (R_3(I_T))$ $\qquad V_A = 32 - (733\frac{1}{3}(0.018))$ $\qquad V_A = 32 - 13.19$ $\qquad V_A \approx 18V$

$R_{2,3,4,6,7,8,9} = 733\frac{1}{3}$ ... current should split



$I_3 = 0.009$

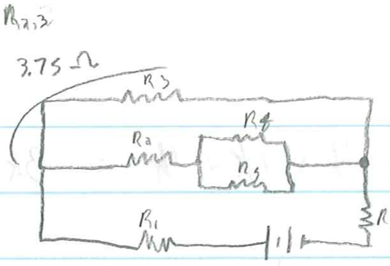
-6

* current flows out negative...

$V_A' = V_T - V_A = V_A' = 50 - 18$

new voltage for $V_A = 32V$

3.



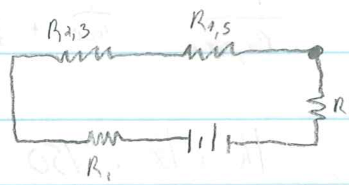
NOT 1/R

$$\frac{1}{R_{2,3}} = \frac{1}{R_2} + \frac{1}{R_3} \qquad \frac{1}{R_{2,3}} = \frac{1}{6} + \frac{1}{10} = \frac{5}{30} + \frac{3}{30} =$$

$$\frac{8}{30} = \frac{30}{8} = 3.75$$

✓

$$\frac{1}{R_{4,5}} = \frac{1}{R_4} + \frac{1}{R_5} = \frac{1}{8} + \frac{1}{4} = \frac{3}{8} = \frac{8}{3} = 2\tfrac{2}{3}$$



$$R_T = R_1 + R_{2,3} + R_{4,5} + R_6 = 0.5 + 3.75 + 2\tfrac{2}{3} + 5 =$$

$11.917\ \Omega$ ✗

$$I_T = \frac{V_T}{R_T} = \frac{9}{11.917} = 0.755$$

units

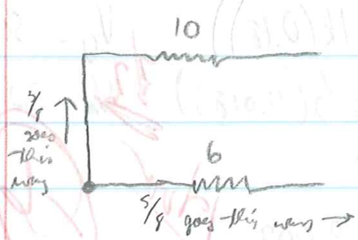
$$V_p = V_T - (V_1 + V_{2,3} + V_{4,5})$$

$$V_p = ((0.755)(0.5)) + ((3.75)(0.755)) + ((2.666)(0.755))$$

$$V_p = 0.03775 + 2.83125 + 2.01283$$

$$V_p = 9 - (4.88183) \qquad V_p = 4.118$$

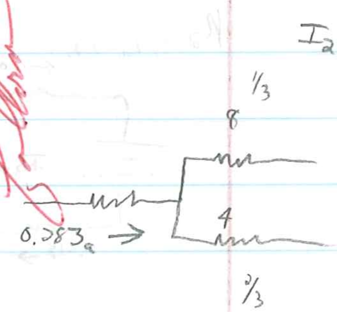
method OK



$$I_2 = I_T(5/8) \qquad I_2 = 0.472$$

$$I_3 = I_T(3/8) \qquad I_3 = 0.283$$

can't follow



$$R_5 = I_2(2/3) \qquad R_5 = 0.189\ \Omega$$

Brandon Buchanan
Infosec

* Charges
- positive - proton
- negative - electron
- measured in Coulumbs
- 1 coulumbs = 6.25 · 10^{18} electrons

* potential - measure of work
- available due to seperation of charges
- 1 V = the work of 1 joules seperating a charge of 1 coulumbs

* current - flow of charges
- measured in amps
- 1 Amp = the flow of 1 coulumb of charges past a point every second
- two types - electron current and conventional current
- electron current moves electrons; conducters
- conventional current moves holes; semiconductors
- holes = absence of electron
- restitence - opposition of current
- resistence is measured in Ohm's (Ω)
- for electricity to be useful, it must have a complete path called a circuit
- functioning circuit is called closed circuit (complete path)
- open circuit has no path
- short circuit - when the path is circumvented

* Kinds of Electrical Flow
- AC - alternate current, polarity changes
- DC - direct current, electron flows til end, constant polarity, battery

- both types exist in a computer
- fans & motors run on AC

* OHM's Law

- $V = IR$ voltage = current · resistance
- T, G, M, K

  m, M, n, p - milli, micro, nano, pico

  10^{-3}, 10^{-6}, 10^{-9}, 10^{-12}