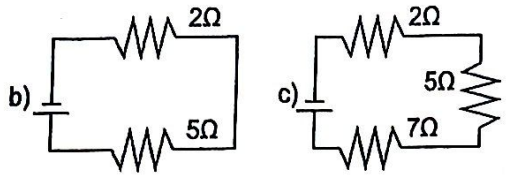
Date: Key

WORKSHEET: QUANTITIES IN CIRCUITS

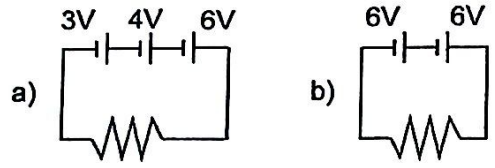
1. Determine the equivalent (total) resistance for each of the following circuits below.



Circuit B: R_T = 7 Ω

Circuit C: R_T = 14 Ω

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

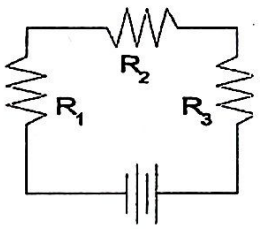


Circuit A: V_T = 13 V

Circuit B: V_T = 12 V

3. Fill out the table for the circuit diagramed at the right. (Note - The resistance of each is different, which means the resistors are not identical. You will need to use Ohm's Law to find some of these quantities)

Circuit Position	Voltage (V)	Current (A)	Resistance (Ω)
1	1.00	0.10	10.0
2	2.00	0.10	20.0
3	3.00	0.10	30.0
Total	6.00	0.10 ①	60.0

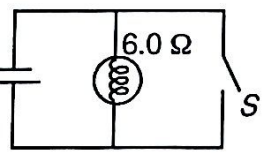


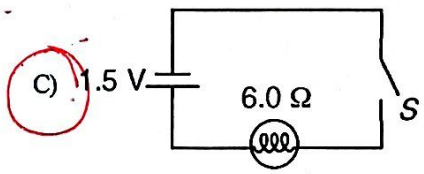
① $I = \frac{V}{R} = \frac{6.00\,V}{60.0\,\Omega} = 0.10\,A$ Find I_{Total}. All other I's are equal.

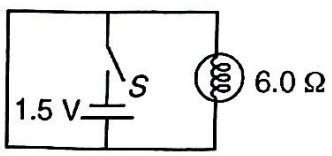
② $V = IR$ – use to find all missing V's.

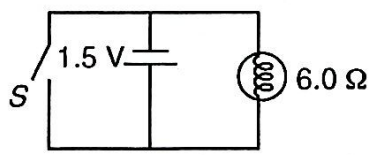
R I.

4) 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?

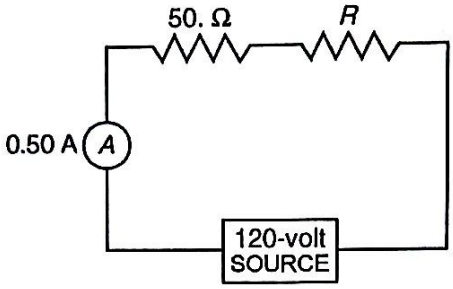
A) 

C) 

B) 

D) 

Questions 5 and 6 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.



5) **Calculate** the total resistance of the circuit shown.

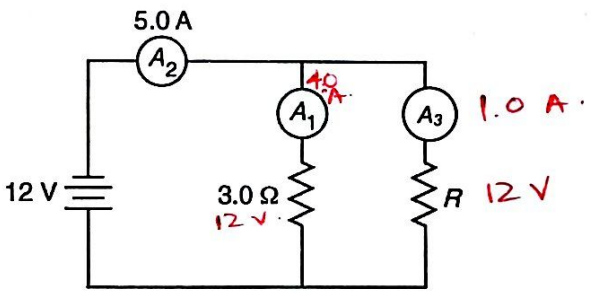
$R_T = \frac{V}{I} = \frac{120\ V}{0.50\ A} = 240\ \Omega$.

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

$R + 50\ \Omega = 240\ \Omega$.

$\therefore\ R = 240\ \Omega - 50\ \Omega = 190\ \Omega$.

Questions 7 through 10 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.



7) Determine the voltage drop across resistor R. — 12 V (parallel circuit - all Vs equal).
8) Calculate the current measured by ammeter A_1 in the diagram shown.
9) Determine the current measured by ammeter $A3$ in the diagram.
10) Calculate the resistance of resistor R.

8) $I = \frac{V}{R} = \frac{12\ V}{3.0\ \Omega} = 4.0\ A$.

10). $R = \frac{V}{I} = \frac{12\ V}{1.0\ A}$

$R = 12\ \Omega$

9). $A_1 + A_3 = 5.0\ A$

$\therefore\ A_3 = 5.0 - A_1$

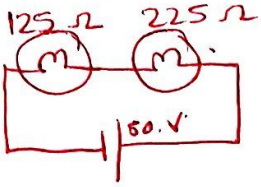
$= 5.0\ A - 4.0\ A$

$A_3 = 1.0\ A$.

11) 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) Draw a circuit diagram for this circuit.
b) Find the total resistance of the circuit.
c) Find the current in the circuit.
d) Find the potential difference across the 125-Ω lamp.

a)



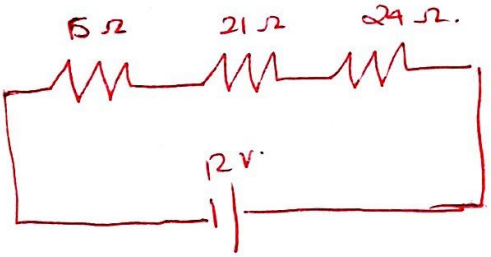
b) $R_T = 125\ \Omega + 225\ \Omega.$

$R_T = 350\ \Omega$

c) $I = \frac{V}{R} = \frac{50.0\ V}{350.\ \Omega} = 0.142\ A$

12) 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. Find the circuit current?



b). $R_T = 15 + 21 + 24 = 60\ \Omega$

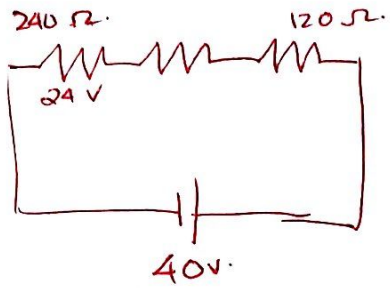
c). $I = \frac{V}{R} = \frac{12\ V}{60\ \Omega.} = 0.20\ A$

13) 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.



a) $I = \frac{V}{R} = \frac{24\text{ V}}{240\ \Omega} = 0.10\text{ A}$

b) $R = \frac{V}{I} = \frac{40.}{0.10\text{ A}} = 400\ \Omega$

c) $R_2 = 400 - 240 - 120$

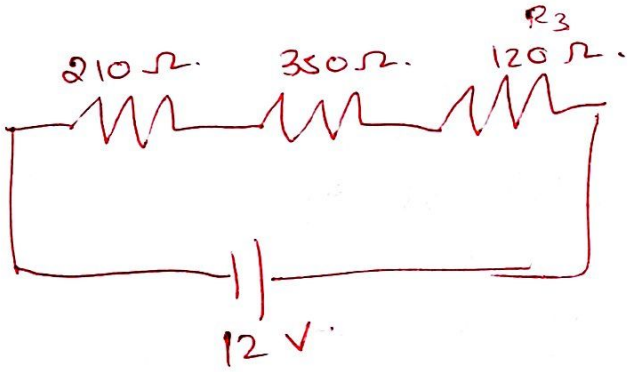
$R_2 = 40\ \Omega.$

14) 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.



a) $R_T = 210 + 350 + 120$

$R_T = 680\ \Omega$

b) $I = \frac{V}{R} = \frac{12\text{ V}}{680\ \Omega}$

$I = 0.018\text{ A}$

c) $V = IR$

$= (0.018\text{ A})(120\ \Omega)$

$V = 2.16\text{ V}$

Answers

1b) 7 Ω
1c) 14 Ω
2a) 13 V 2b) 12 V 4) C
5) 240 Ω
6) 190 Ω
7) 12 V
8) 4.0 A 9) 1.0 A 10) 12 Ω
11b) 350. Ω
11c) 0.143 A
11d) 17.9 V
12b) 60 Ω
12c) 0.20 A
13a) 0.10 A
13b) 400 Ω
13c) 40 Ω
14a) 680 Ω
14b) 0.018 A
14c) 2.2 V