KEY

Circuits Practice

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

a.) $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + ... + \frac{1}{R_n}$ $\frac{1}{R_p} = \frac{1}{7} + \frac{1}{5} + \frac{1}{2}$ $\frac{1}{R_p} = 1.18\ \Omega$

b.) $R_s = R_1 + R_2 + R_3 ... + R_n$ $R_s = 5 + 2$ $R_s = 7\ \Omega$

c.) $R_s = R_1 + R_2 + R_3 ... + R_n$ $R_s = 5 + 2 + 7$ $R_s = 14\ \Omega$

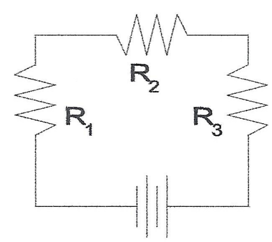
2.) Determine the total voltage (electric potential) for each of the following circuits below.

a.) Add the voltages $= 13V$

b.) Add the voltages $= 12V$

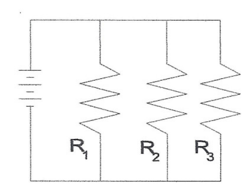
3.) Fill out the table for the circuit diagramed at the right.

Circuit Position	Voltage (V)	Current (A)	Resistance (Ω)
1	1.0	0.10	10.0
2	2.0	0.10	20.0
3	3.0	0.10	30.0
Total	6.00	0.10	60.0



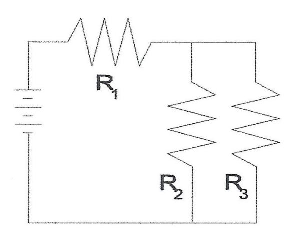
4.) Fill out the table for the circuit diagramed at the right.

Circuit Position	Voltage (V)	Current (A)	Resistance (Ω)
1	6.00	0.60	10.0
2	6.00	0.30	20.0
3	6.00	0.20	30.0
Total	6.00	1.1	5.45

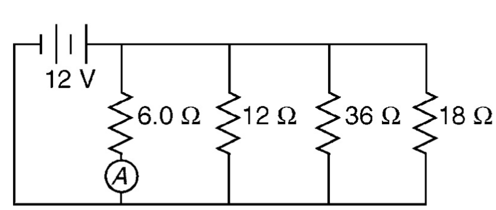


5.) Fill out the table for the circuit diagramed at the right.

Circuit Position	Voltage (V)	Current (A)	Resistance (Ω)
1	2.73	0.273	10.0
2	3.27	0.164	20.0
3	3.27	0.109	30.0
Total	6.00	0.273	22.0



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.

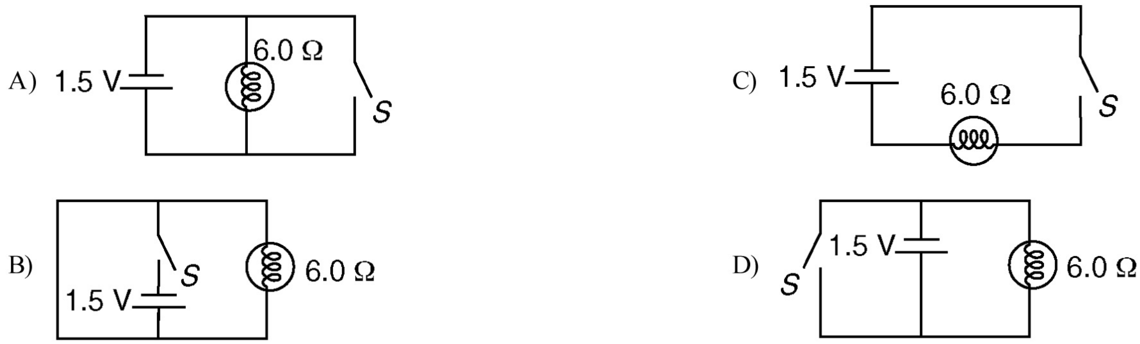


KEY

6.) What is the equivalent resistance of the circuit shown? $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + ... + \frac{1}{R_n}$ $\frac{1}{R_p} = \frac{1}{6} + \frac{1}{12} + \frac{1}{36} + \frac{1}{18}$ $\frac{1}{R_p} = 2.77\ \Omega$

7.) What is the current measured by ammeter *A* shown in the diagram? $V = IR$ $12 = I6.0$ $I = 2.0\ A$

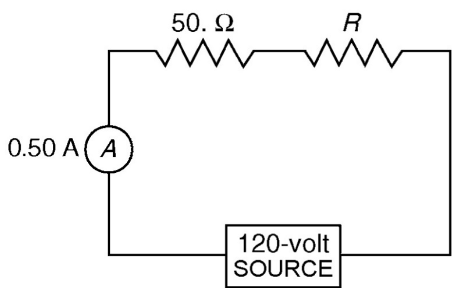
8.) A $6.0\ \Omega$ lamp requires $0.25\ A$ of current to operate. In which circuit below would the lamp operate correctly when switch *S* is closed?



Answer - C

Questions 9 and 10 refer to the following:

A $50.\ \Omega$ resistor, an unknown resistor *R*, a $120.\ V$ source, and an ammeter are connected in a complete circuit. The ammeter reads $0.50\ A$.

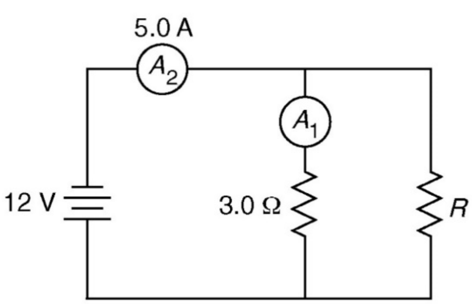


9.) Calculate the equivalent resistance of the circuit shown. $V = IR$ $120 = 0.50R$ $R = 240.\ \Omega$

10.) Determine the resistance of resistor *R* shown in the diagram. $R_s = R_1 + R_2 ... + R_n$ $240. = 50. + R$ $R_s = 190.\ \Omega$

Questions 11 through 13 refer to the following:

A $3.0\ \Omega$ resistor, an unknown resistor, *R*, and two ammeters, A_1 and A_2, are connected as shown below with a $12\ V$ source. Ammeter A_2 reads a current of $5.0\ A$.



11.) Determine the equivalent resistance of the circuit shown.
$V = IR$ $12 = 5.0R$ $R = 2.4\ \Omega$

12.) Calculate the current measured by ammeter A_1 in the diagram shown.
$V = IR$ $12 = I \times 3.0$ $I = 4.0\ A$

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

$\frac{1}{R_p} = \frac{1}{R_1} + .. + \frac{1}{R_n}$ $\frac{1}{2.4} = \frac{1}{R} + \frac{1}{3}$ $R_p = 12\ \Omega$

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14.) The load across a $50.0\ V$ battery consists of a series combination of two lamps with resistances of $125\ \Omega$, and $225\ \Omega$.

a. Find the total resistance of the circuit.

$R_s = R_1 + R_2 \ldots + R_n$ $\quad R_s = 125 + 225$ $\quad R_s = 350.\ \Omega$

b. Find the current in the circuit.

$V = IR$ $\quad 50.0 = I350.$ $\quad I = 0.143\ A$

c. Find the potential difference across the $125\ \Omega$ lamp.

$V = IR$ $\quad V = (0.143)(125)$ $\quad I = 17.9\ V$

15.) The load across a $12\ V$ battery consists of a series combination of three resistances. They are $15\ \Omega$, $21\ \Omega$, and $24\ \Omega$, respectively.

a. Draw the circuit diagram.

b. What is the total resistance of the load?

$R_s = R_1 + R_2 \ldots + R_n$ $\quad R_s = 15 + 21 + 24$ $\quad R_s = 60.\ \Omega$

c. What is the magnitude of the circuit current?

$V = IR$ $\quad 12 = I \times 60.$ $\quad I = 0.20\ A$

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 $240.\ \Omega$ and R_3 is $120.\ \Omega$. The potential difference across R_1 is $24\ V$.

a. Find the current in the circuit.

$V = IR$ $\quad 24 = I \times 240.$ $\quad I = 0.10\ A$

b. Find the equivalent resistance of the circuit.

$V = IR$ $\quad 40 = 0.10 \times R$ $\quad R = 400\ \Omega$

c. Find the resistance of R_2.

$R_s = R_1 + R_2 \ldots + R_n$ $\quad 400 = 240 + 120 + R_2$ $\quad R_2 = 40.\ \Omega$

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 $210.\ \Omega$, R_2 is $350.\ \Omega$, and R_3 is $120.\ \Omega$.

a. Find the equivalent resistance of the circuit.

$R_s = R_1 + R_2 \ldots + R_n$ $\quad R_s = 210. + 350. + 120.$ $\quad R_2 = 680.\ \Omega$

b. Find the current in the circuit.

$V = IR$ $\quad 12 = I \times 680.$ $\quad I = 0.018\ A$

c. Find the potential difference across R_3.

$V = IR$ $\quad V = 0.01764 \times 120.$ $\quad V = 2.12\ V$

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

$\frac{1}{R_p} = \frac{1}{R_1} + .\,. + \frac{1}{R_n}$ $\quad \frac{1}{R_p} = \frac{1}{12} + \frac{1}{18}$ $\quad R_p = 7.2\ \Omega$

19.) Three resistances of $12\ \Omega$ each are connected in parallel. What is the equivalent resistance?

$\frac{1}{R_p} = \frac{1}{R_1} + .\,. + \frac{1}{R_n}$ $\quad \frac{1}{R_p} = \frac{1}{12} + \frac{1}{12} + \frac{1}{12}$ $\quad R_p = 4.0\ \Omega$

20.) Two resistances, one $62\ \Omega$ and the other $88\ \Omega$, are connected in parallel. The resistors are then connected to a $12\ V$ battery.

a. What is the equivalent resistance of the parallel combination?

$\frac{1}{R_p} = \frac{1}{R_1} + .\,. + \frac{1}{R_n}$ $\quad \frac{1}{R_p} = \frac{1}{62} + \frac{1}{88}$ $\quad R_p = 36\ \Omega$

b. What is the current through each resistor?

$V = IR$ $\quad 12 = (I)(62)$ $\quad I = 0.19\ A$

$V = IR$ $\quad 12 = (I)(88)$ $\quad I = 0.14\ A$

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?

$P = VI$ $\quad 2600 = (110.)(I)$ $\quad I = 23.6\ A$

Yes, $20\ A$ fuse is too small.

22.) A $35\ \Omega$, $55\ \Omega$, and $85\ \Omega$ 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?

$\frac{1}{R_p} = \frac{1}{R_1} + .\,. + \frac{1}{R_n}$ $\quad \frac{1}{R_p} = \frac{1}{35} + \frac{1}{55} + \frac{1}{55}$ $\quad R_p = 17\ \Omega$

b. What is the current through each resistor?

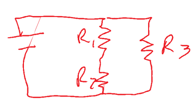
$V = IR$ $\quad 35 = I \times 35.$ $\quad I = 1.0\ A$

$V = IR$ $\quad 35 = I \times 55.$ $\quad I = 0.64\ A$

$V = IR$ $\quad 35 = I \times 85.$ $\quad I = 0.41\ A$

23.) Resistors R_1, R_2, and R_3 have resistances of $15.0\ \Omega$, $9.0\ \Omega$, and $8.0\ \Omega$ 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?

$\frac{1}{R_p} = \frac{1}{R_1} + .\,. + \frac{1}{R_n}$ $\quad \frac{1}{R_p} = \frac{1}{24} + \frac{1}{8.0}$ $\quad R_p = 6.0\ \Omega$

c. What is the current in R_3?

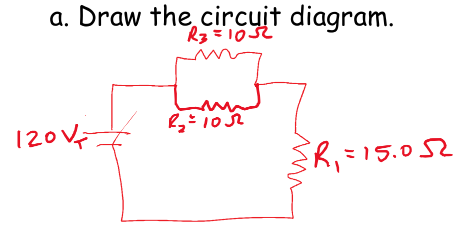
$V = IR$ $\quad 6.0 = I \times 8.0.$ $\quad I = 0.75\ A$

d. What is the potential difference across R_2?

$V = IR$ $\quad V = 0.25 \times 9.0$ $\quad V = 2.25\ V$

24.) A $15.0\ \Omega$ resistor is connected in series to a $120\ V$ generator and two $10.0\ \Omega$ resistors that are connected in parallel to each other.

a. Draw the circuit diagram.



b. What is the total resistance of the load?

$R_s = R_1 + R_2 \ldots + R_n$ $R_s = 15 + 5$ $R_s = 20.\,\Omega$

c. What is the magnitude of the circuit current?

$V = IR$ $120 = I \times 20.$ $I = 6.0\ A$

d. What is the current in one of the 10.0 Ω resistors?

$V = IR$ $30 = I \times 10.$ $I = 3.0\ A$

e. What is the potential difference across the 15.0 Ω resistor?

$V = IR$ $V = 15.0 \times 6.0$ $V = 90.0\ V$

<u>Answers</u>

1a) $1.2\ \Omega$	1b) $7\ \Omega$	1c) $14\ \Omega$
2a) $13\ V$	2b) $12\ V$	6) $3.0\ \Omega$
7) $2.0\ A$	8) C	9) $240.\ \Omega$
10) $190\ \Omega$	11) $2.4\ \Omega$	12) $4.0\ A$
13) $12\ \Omega$	14a) $350.\ \Omega$	14b) $0.143\ A$
14c) $17.9\ V$	15b) $60.\ \Omega$	15c) $0.20\ A$
16a) $0.10\ A$	16b) $400.\ \Omega$	16c) $40.\ \Omega$
17a) $680.\ \Omega$	17b) $0.018\ A$	17c) $2.1\ V$
18) $7.2\ \Omega$	19) $4.0\ \Omega$	20a) $36\ \Omega$
20b) $62\ \Omega = 0.19\ A;\ 88\ \Omega = 0.14\ A$		
21) $I = 23.6\ A$ so fuse will pop		22a) $17\ \Omega$
22b) $I35\ \Omega = 1.0\ A;\ I55\ \Omega = 0.64\ A;\ I85\ \Omega = 0.41\ A$		
23b) $6.0\ \Omega$	23c) $0.75\ A$	23d) $2.3\ V$
24b) $20.0\ \Omega$	24c) $6.0\ A$	24d) $3.0\ A$
24e) $90.\ V$		