CIRCUITS WORKSHEET

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

   a) ![Resistor Diagram A]
   b) ![Resistor Diagram B]
   c) ![Resistor Diagram C]

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

   a) ![Voltage Diagram A]
   b) ![Voltage Diagram B]

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

<table>
<thead>
<tr>
<th></th>
<th>$R_1$</th>
<th>$R_2$</th>
<th>$R_3$</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V$</td>
<td></td>
<td></td>
<td></td>
<td>$6V$</td>
</tr>
<tr>
<td>$I$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R$</td>
<td>10</td>
<td>20</td>
<td>30</td>
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<td>$40V$</td>
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</tr>
<tr>
<td>$R$</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td></td>
</tr>
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<td></td>
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<tr>
<td>$I$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R$</td>
<td>10Ω</td>
<td>20Ω</td>
<td>30Ω</td>
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</table>

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.
6) What is the equivalent resistance of the circuit shown?

7) What is the current measured by ammeter A shown in the diagram?

8) A 6.0-ohm lamp requires 0.25 amperes of current to operate. In which circuit below would the lamp operate correctly when switch S is closed?

   A) 1.5 V ± 6.0 Ω
   B) 1.5 V ± 6.0 Ω
   C) 1.5 V ± 6.0 Ω
   D) 1.5 V ± 6.0 Ω

Questions 9 and 10 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.

9) Calculate the equivalent resistance of the circuit shown.

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

Questions 11 through 13 refer to the following:
A 3.0-ohm resistor, an unknown resistor, R, and two ammeters, A₁ and A₂, are connected as shown below with a 12-volt source. Ammeter A₁ reads a current of 5.0 amperes.

11) Determine the equivalent resistance of the circuit shown.

12) Calculate the current measured by ammeter A₁ in the diagram shown.

13) Calculate the resistance of the unknown resistor, R in the diagram shown.
14. 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. Find the total resistance of the circuit.
   b. Find the current in the circuit.
   c. Find the potential difference across the 125-Ω lamp.

15. 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. What is the magnitude of the circuit current?

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 Ω and $R_2$ 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 $R_2$.

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 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 $R_3$.

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

19. Three resistances of 12 Ω each are connected in parallel. What is the equivalent resistance?

20. Two resistances, one 62 Ω and the other 88 Ω, are connected in parallel. The resistors are then connected to a 12-V battery.
   a. What is the equivalent resistance of the parallel combination?
   b. What is the current through each resistor?

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?
22. A 35-Ω, 55-Ω, and 85-Ω 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?
   b. What is the current through each resistor?

23. Resistors $R_1$, $R_2$, and $R_3$ have resistances of 15.0 Ω, 9.0 Ω, and 8.0 Ω 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?
   c. What is the current in $R_3$?
   d. What is the potential difference across $R_3$?

24. A 15.0-Ω resistor is connected in series to a 120-V generator and two 10.0-Ω resistors that are connected in parallel to each other.
   a. Draw the circuit diagram.
   b. What is the total resistance of the load?
   c. What is the magnitude of the circuit current?
   d. What is the current in one of the 10.0-Ω resistors?
   e. What is the potential difference across the 15.0-Ω resistor?

Answers:

1a) 1.2 Ω  
1b) 7Ω  
1c) 14Ω  
2a) 13V  
2b) 12V  
2c) 3.0Ω  
7) 2.0A  
8) C  
9) 240Ω  
10) 190Ω  
11) 2.4Ω  
12) 4.0A  
13) 12Ω  
14a) 350Ω  
14b) 0.143A  
14c) 17.9V  
15b) 60Ω  
15c) 0.20A  
16a) 0.10A  
16b) 400Ω  
16c) 40Ω  
17a) 680Ω  
17b) 0.018A  
17c) 2.2V  
18) 7.2Ω  
19) 4.0Ω  
20a) 36Ω  
20b) $I_{load} = 0.19A; I_{fus} = 0.14A$
21) $I = 23.6A$ so fuse will melt  
22a) 17Ω  
22b) $I_{load} = 1.0A; I_{fus} = 0.64A; I_{load} = 0.41A$
23b) 6.0Ω  
23c) 0.75A  
24b) 2.3V  
24a) 20.0Ω  
24c) 6.0A  
24d) 3.0A  
24e) 90.0V
1. Find the current and voltage for all components in the following circuit.

2. 2 light bulbs are rated for 45 W; 75 W when located on a 120 V electrical circuit. If the battery producing the 120 V has an internal resistance of 0.2 ohm, what is the current through the battery if the light bulbs are connected in series or parallel?
CIRCUITS WORKSHEET

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

   a) [Diagram of a circuit with three resistors in series: 7Ω, 5Ω, 2Ω]
   b) [Diagram of a circuit with two resistors in parallel: 2Ω, 5Ω]
   c) [Diagram of a circuit with three resistors in parallel: 2Ω, 5Ω, 7Ω]

   9. \( \frac{1}{R_{eq}} = \frac{1}{7} + \frac{1}{5} + \frac{1}{2} = 1.18 \Omega \)
   b. \( R_{eq} = 2 + 5 = 7 \Omega \)
   c. \( R_{eq} = 2 + 5 + 7 = 14 \Omega \)

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

   a) [Diagram of a circuit with three resistors in series: 3V, 4V, 6V]
   b) [Diagram of a circuit with two resistors in parallel: 6V, 6V]

   9. \( 3 \text{V} + 4 \text{V} + 6 \text{V} = 13 \text{V} \)
   b. \( 6 \text{V} + 6 \text{V} = 12 \text{V} \)

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<tbody>
<tr>
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<td>( 6 \text{V} )</td>
<td>( 6 \text{V} )</td>
<td>( 6 \text{V} )</td>
</tr>
<tr>
<td>( I )</td>
<td>( 5 \text{mA} )</td>
<td>( 15 \text{mA} )</td>
<td>( 6 \text{mA} )</td>
<td>( 12 \text{mA} )</td>
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<tr>
<td>( R )</td>
<td>( 6 \text{k} )</td>
<td>( 20 \text{k} )</td>
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<td>( 54 \text{k} )</td>
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<tr>
<td>( P )</td>
<td>( 3.6 \text{W} )</td>
<td>( 1.8 \text{W} )</td>
<td>( 1.2 \text{W} )</td>
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<tbody>
<tr>
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<td>( 3.24 \text{V} )</td>
<td>( 3.24 \text{V} )</td>
<td>( 6 \text{V} )</td>
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<tr>
<td>( I )</td>
<td>( 3.27 \text{mA} )</td>
<td>( 1.62 \text{mA} )</td>
<td>( 1.08 \text{mA} )</td>
<td>( 2.77 \text{mA} )</td>
</tr>
<tr>
<td>( R )</td>
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<td>( 5.2 \text{W} )</td>
<td>( 3.4 \text{W} )</td>
<td>( 16 \text{W} )</td>
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The diagram to the right represents an electric circuit consisting of four resistors and a 12-volt battery.

\[ \frac{1}{R_{eq}} = \frac{1}{6} + \frac{1}{12} + \frac{1}{36} + \frac{1}{18} \]
\[ R_{eq} = 3 \Omega \]

\[ I_T = \frac{12 \text{V}}{R_{eq}} = \frac{12 \text{V}}{3 \Omega} = 4 \text{A} \]
6) What is the equivalent resistance of the circuit shown?

7) What is the current measured by ammeter A shown in the diagram?

8) 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?

Questions 9 and 10 refer to the following:

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11) Determine the equivalent resistance of the circuit shown.

12) Calculate the current measured by ammeter A₁ in the diagram shown.

13) Calculate the resistance of the unknown resistor, R, in the diagram shown.
14. \[ V = 50 \text{ V}, \quad R_{1} = 1.25 \Omega, \quad R_{2} = 2.5 \Omega, \quad I_{T} = \frac{50}{350} = 0.143 \text{ A} \]

<table>
<thead>
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<th>( R_{2} )</th>
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<td>2.5 \Omega</td>
<td>350 \Omega</td>
<td>0.143 A</td>
</tr>
</tbody>
</table>

15-20. You do answers on sheet. Use equivalent circuit and V-I-P-R table!!

21. \[ P \text{ for circuit} = \frac{\sqrt{2}}{R_{eq}} \]
\[ 3600 \Omega = \frac{110^2}{R_{eq}} \]
\[ R_{eq} = 3.36 \Omega \]

\[ I_{T} = \frac{V_{T}}{R_{eq}} = \frac{110}{3.36} \]
\[ I_{T} = 32.7 \text{ A} \]

Note: Answer on sheet is wrong.
\[ \frac{1}{R_{eq}} = \frac{1}{8} + \frac{1}{2\Omega} = \]

\[ R_{eq} = 6 \Omega \]

\[ \frac{\text{T} = 2\Omega}{12} = 2 \Omega \]