Circuits and Ohm's Law Review
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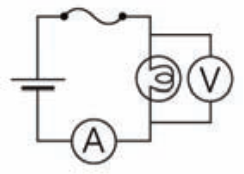
1. (a) The circuit is a series circuit.
(b) The circuit contains a 9.0-V cell, two ammeters, two bulbs, and two voltmeters.
(c) The voltage at V1 in the circuit is the total circuit voltage as provided by the cell (9.0 V) minus the voltage drop over the first bulb (4.0 V), so 9.0 V – 4.0 V = 5.0 V.
(d) The circuit is a series circuit with only one current path, therefore the current at A1 in the circuit is the total circuit current as measured at the other ammeter (3.0 A), so 3.0 A.

2.



3. A parallel circuit contains multiple current pathways, whereas a series circuit contains only one.

4. (a) When any one bulb in a series circuit burns out, none of the bulbs will remain lit.
(b) When any one bulb in a parallel circuit burns out, the others will remain lit.

5. Circuits in a home are connected in parallel with one another. This is done so that over-current that will cause a fuse to fail or a breaker to trip in one circuit does not adversely affect the rest of the circuits in the system.

6. An open circuit has a break in it or has an open switch. Current does not flow in an open circuit. A closed circuit contains no breaks and has no open switches. Current flows in a closed circuit.
A short circuit contains an unintentional path for current to flow to ground. Current flows in a short circuit although not in the intended current pathway.

7. (a) A circuit in which the voltage is the same across every resistor is a parallel circuit.
(b) A circuit in which the voltage varies across each resistor is a series circuit.
(c) A circuit in which the current varies through each resistor is a parallel circuit.
(d) A circuit in which the current remains constant throughout the whole circuit is a series circuit.

8.
Given
I = 1.5 A
R = 30 Ω
Required
V = ?
Analysis and Solution
$V = IR$.
Substitute the values and their units, and then solve the problem.
= (1.5 A)(30 Ω)
= 45 V
Statement
The voltage of the battery is 45 V.

9.
Given
V = 120 V
I = 10 A
Required
R = ?
Analysis and Solution
R = V/I
Substitute the values and their units, and then solve the problem.
= (120 V)/(10 A)
= 12 Ω
Statement
The resistance of the appliance is 12 Ω.

10. (a) 1.6 MV = 1 600 000 V
(b) 1500 W = 1.5 kW
(c) 650 mA = 0.65 A

11. (a)
Given
V = 6.0 V
I = 2.0 mA (0.002 A)
RequiredR = ?
Analysis and Solution
R = V/I
Substitute the values and their units, and then solve the problem.
= 6.0V/0.002A
= 3000 Ω
Statement
The value of the resistor is 3000 Ω.

(b) What is the driving voltage in a circuit containing a 3000-Ω resistor transforming 2.0 mA of current? How much current flows in a circuit containing a 6.0-V cell and a 3000-Ω resistor?

12. (a) Students' answers will vary but for a series circuit could include a NASCAR race track in which all cars must travel the same path to the finish line.

(b) Students' answers will vary but for a parallel circuit could include a race such as the 100-m dash in which the runners travel on separate, parallel paths to the finish line.

13. (a) Knives are conductive and if introduced into a toaster that is plugged in can allow electric current to flow through the user holding the knife.

(b) An extension cord thinner than the cord on the appliance plugged into it may overheat due to its smaller diameter.

(c) Pulling on the cord of an appliance may damage the cord of the appliance, creating a potentially dangerous situation for the user.

(d) Plugging too many cords into one outlet may cause too much current to be drawn from that outlet, risking overheating or fire.

(e) A kite, stick, or pole used near overhead power lines may act as a conductor, allowing current to flow through the user to ground. This is a very dangerous situation and should always be avoided.

(f) Wet hands are very conductive. Dry hands help to prevent creating alternate current pathways to ground through the user's body.

(g) A frayed electrical cord can create a short-circuit fire risk or possibly provide a dangerous electrical shock to the user.

14. (a) The situation depicts a worker standing in a puddle of water caused by a dripping tap. The working is operating a power tool whose cord is also in the puddle of water. The water makes a very good conductor and provides a short-circuit or electric shock hazard.

(b) The worker should close the tap and ensure that she herself along with her workspace and the electrical tools she is using are completely dry.

(c) The third prong on the plug provides a low-resistance path to ground. The intention is for any stray current to travel this low resistance path rather than a path through the user.

15. Current in a circuit could be increased by increasing the driving voltage in the circuit or by decreasing the resistance of the loads attached to the circuit.

16. The lamp cord has a much lower resistance than the bulb filament.
Therefore, the lamp cord does not convert much electrical energy to heat and does not heat up in the same way the light-bulb filament does.

17. Connect the resistor in a simple series circuit with the ammeter and battery. Use the voltmeter to measure the voltage drop across the resistor and the ammeter to determine the current flowing at the same time. The resistance of the resistor will be the driving voltage divided by the current flow.