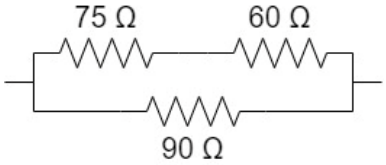
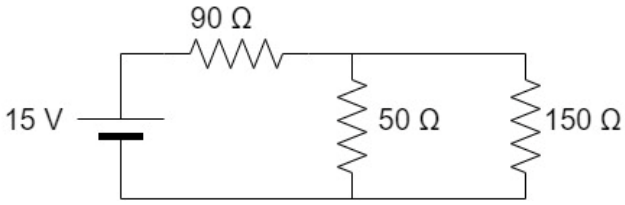
Physics Unit 8: Circuits Review

1. Know about charge, current, potential, voltage, resistance, resistors, circuit diagrams, series, parallel, ammeters, voltmeters, power, kWh, AC/DC, thermal hazards, shock hazards
2. A 15-A current is maintained in a simple circuit with a total resistance of 2000 Ω. What net charge passes through any point in the circuit during a 2-second interval?
3. When a light bulb is connected to a 24 V battery, a current of 0.2 A passes through the bulb filament. What is the resistance of the filament?
4. Three resistors, 100-Ω, 125-Ω, 150-Ω, are connected in series in a circuit. What is the equivalent resistance of this combination of resistors?
5. Ten 50-Ω and five 25-Ω light bulbs and a 9 V battery are connected in a series circuit. What is the current that passes through each bulb?
6. Three resistors, 100-Ω, 125-Ω, 150-Ω, are connected in parallel in a circuit. What is the equivalent resistance of this combination of resistors?
7. Two resistors, 50-Ω and 25-Ω, are connected in parallel with a 24 V battery. What is the total current in the circuit?
8. Three resistors are connected as shown in the figure. The potential difference between points A and B is 12 V. What is the equivalent resistance between the points A and B?



Use the circuit diagram to answer 9 and 10.



9. What is the equivalent resistance of the circuit?
10. What is the current in the 90 Ω resistor?
11. A 15-A current is maintained in a simple circuit with a total resistance of 1500 Ω. How much energy is dissipated in 5 seconds?
12. A 15-A current is maintained in a simple circuit that consists of a resistor between the terminals of an ideal battery. If the battery supplies energy at a rate of 75 W, how large is the resistance?
13. An AC current has a peak value of 8.49 A. Determine the rms value of the current.

Physics Unit 8: Circuits Review

Answers

2. $I = \frac{Q}{t}$
   $15\ A = \frac{Q}{2\ s}$
   $Q = \mathbf{30\ C}$

3. $V = IR$
   $24\ V = (0.2A)R$
   $R = \mathbf{120\ \Omega}$

4. $R_{eqv} = 100\ \Omega + 125\ \Omega + 150\ \Omega = \mathbf{375\ \Omega}$

5. Series has same current through all bulbs.
   $R_{eqv} = 10(50\ \Omega) + 5(25\ \Omega) = 625\ \Omega$
   $V = IR_{eqv}$
   $9\ V = I(625\ \Omega)$
   $I = \mathbf{0.0144\ A}$

6. $\frac{1}{R_{eqv}} = \frac{1}{100\ \Omega} + \frac{1}{125\ \Omega} + \frac{1}{150\ \Omega}$
   $\frac{1}{R_{eqv}} = 0.02467\ \frac{\square}{\Omega}$
   $R_{eqv} = \mathbf{40.5\ \Omega}$

7. $\frac{1}{R_{eqv}} = \frac{1}{50\ \Omega} + \frac{1}{25\ \Omega}$
   $\frac{1}{R_{eqv}} = 0.06\ \frac{\square}{\Omega}$
   $R_{eqv} = 16.7\ \Omega$
   $V = IR_{eqv}$
   $24\ V = I(16.7\ \Omega)$
   $I = \mathbf{1.44\ A}$

8. Do the series part first (most inside).
   $R_{series} = 75\ \Omega + 60\ \Omega$
   $R_{sereis} = 135\ \Omega$
   Combine the parallel branches.
   $\frac{1}{R_{eqv}} = \frac{1}{135\ \Omega} + \frac{1}{90\ \Omega}$
   $\frac{1}{R_{eqv}} = 0.0185\ \frac{\square}{\Omega}$
   $R_{eqv} = \mathbf{54\ \Omega}$

9. Combine the parallel branches.
   $\frac{1}{R_{parallel}} = \frac{1}{50\ \Omega} + \frac{1}{150\ \Omega}$
   $\frac{1}{R_{parallel}} = 0.0267\ \frac{\square}{\Omega}$
   $R_{parallel} = 37.5\ \Omega$
   Combine that in series.
   $R_{eqv} = 90\ \Omega + 37.5\ \Omega$
   $R_{eqv} = \mathbf{127.5\ \Omega}$

10. All the current from the battery goes through the 90 Ω resistor.
    $V = IR_{eqv}$
    $15\ V = I(127.5\ \Omega)$
    $I = \mathbf{0.118\ A}$

11. $P = I^2R$
    $P = (15\ A)^2(1500\ \Omega)$
    $P = 337500\ W$
    $P = \frac{W}{t}$
    $337500\ W = \frac{W}{5\ s}$
    $W = \mathbf{1.69 \times 10^6\ J}$

12. $P = I^2R$
    $75\ W = (15\ A)^2R$
    $R = \mathbf{0.333\ \Omega}$

13. $I_{rms} = \frac{I_0}{\sqrt{2}}$
    $I_{rms} = \frac{8.49\ A}{\sqrt{2}}$
    $I_{rms} = \mathbf{6.00\ A}$