Total time: 1 hr **Total Points: 10 pt** **Student Name:**

Answer the questions in the spaces provided on the question sheets. If you run out of room for an answer, continue on the back of the page.

Ohm's Law $I = \frac{E}{R}$; Power $P = \frac{\text{energy}}{\text{time}}$ $P = IV = I^2R = \frac{E^2}{R}$

1. You connect a load to a 4.5-V battery and measure the electric current to be 1.2 mA. How much is the resistance of the load?

Solution:

$$I = \frac{V}{R} \quad \rightarrow 0.0012 = \frac{4.5}{R} \quad \rightarrow R = 3.75 \text{ k}\Omega$$

2. You connect a 5.2-kΩ resistor to a 9.0-V battery. How much is the electric current?

Solution: $\frac{9.0}{5{,}200} = 1.73$ mA

3. A 2.0-mA current flows through a load that is connected to a 9.0-V battery. What is the power in the load?

Solution: $P = IV = (0.002)(9.0) = 0.018$ W

4. A 200-W lightbulb is connected to the electrical outlet. How much is the current through it?

Solution:

$$P = IV \quad \rightarrow 200 = I(110) \quad \rightarrow I = 1.82 \text{ A}$$

5. A 200-W lightbulb is connected to the electrical outlet. How much is the resistance of it?

Solution:

$P = IV \quad \rightarrow 200 = I(110) \quad \rightarrow I = 1.82 \text{ A} I = \frac{V}{R} \quad \rightarrow 1.82 = \frac{110}{R} \quad \rightarrow R = 60.5\ \Omega$

$$\text{Series: } R = R_1 + R_2 + R_3 + \dots \quad \text{Parallel: } \frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_2} + \dots$$

$$I_{\text{effective}} = 0.707 I_{\max} \quad V_{\text{effective}} = 0.707 V_{\max}$$

$$\text{Generators } \text{EMF} = NAB\omega \quad \text{Transformers } \frac{\text{EMF}_{\text{secondary}}}{\text{EMF}_{\text{primary}}} = \frac{N_{\text{secondary}}}{N_{\text{primary}}}$$

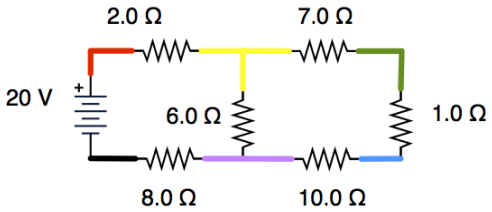

Figure 1: A circuit

6. For the circuit in Fig. 1, which two resistors are in series?
   A. 7.0Ω and 1.0Ω
   B. 2.0Ω and 7.0Ω
   C. 8.0Ω and 10.0Ω

7. For the two resistors in series in the previous question, calculate their total resistance.

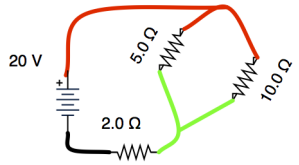

Figure 2: A circuit

8. For the circuit in Fig. 2, which two resistors are in parallel?
   A. 2.0Ω and 5.0Ω
   B. 2.0Ω and 10.0Ω
   C. 5.0Ω and 10.0Ω

9. For the two parallel resistors in the previous question, calculate their total resistance.

10. Which resistors are in series on the circuit in Fig. 3. Calculate their total resistance (of the series only!)

Solution: 8.0 Ω

11. Which resistors are in parallel on the circuit in Fig. 3. Calculate their total resistance (of the parallel only!)

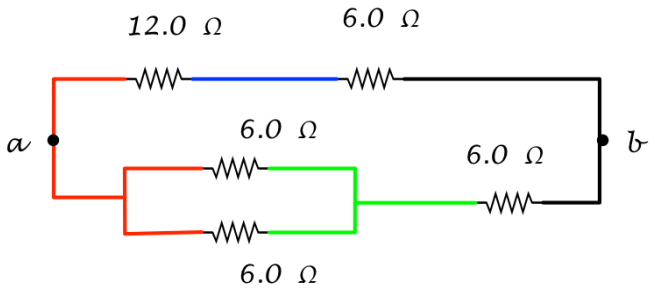

Figure 3: A circuit

Solution: 3.0 *Omega*

12. What maximum EMF can you induce by rotating a single-turn coil at 100 rpm. The area of the coil is 0.25 m^2 and the magnetic field is 0.005 T?

Solution: 100 rpm $= 100 \times \frac{2\pi}{60} = 10.47$ rad/s

$$\text{EMF} = (1)(0.005\text{ T})(0.25\text{ m}^2)(10.47\text{ rad/s}) = 0.013\text{ V}$$

13. An AC generator produces maximum voltage of 160 V. What is the effective value of the voltage?

Solution: $V_{\text{eff}} = 0.707(160) = 113$ V

14. A step-up transformer has 50 turns on its primary coild and 350 turns on its secondary coil. If plugged into 110 V, what will be the voltage on the secondary coil?

Solution:

$$\frac{E_{\text{secondary}}}{110} = \frac{350}{50} \quad \rightarrow E_{\text{secondary}} = 770\text{ V}$$

15. A step-up transformer is connected to 110 V and produces 154 V. If the primary coil has 50 turns, how many turns is the secondary coil?

Solution:

$$\frac{154}{110} = \frac{N}{50} \quad \rightarrow N = 70$$