## Multiple Choice Questions  
1. According to the passage, what constitutes an electric current?  
A. Free charges at rest  
B. Bound charges at rest  
C. Charges in motion  
D. Charges in equilibrium  
2. In the context of electrical conductivity, what are materials generally called that develop electric currents when an electric field is applied?  
A. Insulators  
B. Semiconductors  
C. Conductors  
D. Dielectrics  
3. Ohm's law establishes a relationship between potential difference (V) and current (I) flowing through a conductor. Which of the following accurately represents this relationship, where R is the resistance?  
A. V = I/R  
B. I = VR  
C. V = RI  
D. R = VI  
4. What factor does the resistance (R) of a conductor depend on, according to the passage?  
A. Material of the conductor only  
B. Dimensions of the conductor only  
C. Both the material and dimensions of the conductor  
D. Neither the material nor the dimensions of the conductor  
5. According to the passage, what is the relationship between the resistance (R) of a conductor and its length (l), assuming other factors are constant?  
A. R is inversely proportional to l  
B. R is directly proportional to l  
C. R is independent of l  
D. R is proportional to the square of l  
6. What term is defined as the constant of proportionality, represented by 'ρ', in the equation R = ρl/A?  
A. Conductance  
B. Resistance  
C. Resistivity  
D. Conductivity  
7. What term is used to describe the current per unit area (I/A), taken normal to the current?  
A. Electric flux  
B. Current density  
C. Voltage gradient  
D. Charge density  
8. What does the term σ (sigma) represent in the equation j = σE?  
A. Resistance  
B. Resistivity  
C. Conductivity  
D. Current density  
9. The average time between successive collisions of electrons in a conductor is denoted by which term?  
A. Drift time  
B. Collision interval  
C. Relaxation time  
D. Acceleration period  
## Short Answer Questions  
1. According to the text, what are cells or batteries used for?  
2. What is the SI unit of resistance, and what symbol represents it?  
3. What is the effect on the average speed of electrons in a conductor when the temperature is increased?  
4. According to the text, what must be present in order to maintain a steady current in an electric circuit?  
## Long Answer Questions  
1. N/A  
## Numerical Questions  
1. A copper wire carries a current density of 5 × 10^6 A/m². If the resistivity of copper is 1.7 × 10^-8 Ωm, what is the magnitude of the electric field in the wire?  
2. A nichrome wire has a resistivity of 1.5 × 10^-6 Ωm at 20°C. If the temperature coefficient of resistivity for nichrome is 0.0004/°C, what is its resistivity at 100°C?  
3. A conductor has a length of 2 meters and a cross-sectional area of 4 × 10^-6 m². If its resistance is 5 Ω, what is the resistivity of the material?  
4. A copper wire with a length of 10 meters and a cross-sectional area of 2 × 10^-6 m² carries a current of 2 A. If the voltage across the wire is 10 V, what is the conductivity of the copper?  
5. The drift velocity of electrons in a silver wire is 8 × 10^-4 m/s under an electric field of 0.02 V/m. What is the mobility of the electrons in silver?  
6. A wire has a resistance of 20 Ω. If the length of the wire is doubled and the cross-sectional area is halved, what is the new resistance of the wire?  
7. Two cells with emf 1.5 V each and internal resistances of 0.5 Ω each are connected in series to an external resistor of 4 Ω. What is the current flowing through the circuit?  
8. Three resistors of 10 Ω, 20 Ω, and 30 Ω are connected in parallel. What is the equivalent resistance of the combination?  
9. A battery has an emf of 12 V and an internal resistance of 1 Ω. If a 5 Ω resistor is connected across the terminals of the battery, what is the terminal voltage of the battery?  
10. A 100 W light bulb is connected to a 220 V power supply. What is the current flowing through the bulb?