Chapter 22

Be able to state that 1 coulomb of charge is that amount of 1/(1.6x10^{-19}) = 6.25x10^{18} electrons.

Be able to define electric current I as the amount of charge q that flows past a point in a circuit in a time t divided by this time. \( I = \frac{q}{t} \)

Be able to state that the unit of current is the ampere with 1 a = 1 C / s.

Be able to solve simple problems that relate the charge q delivered by a current I in a time t.

Be able to state that sources of voltage such as generators and batteries cause differences of potential that cause current to flow in resistors.

Be able to explain that current flows out of the positive terminal of generators and batteries and returns into the negative terminal.

Be able to state Ohm’s law, the voltage across a resistor is proportional to the current that flows through it. \( V = IR \).

Be able to define resistance as the constant in ohm’s law, \( R = \frac{V}{I} \)

Be able to solve simple problems that relate current, voltage and resistance.

Be able to state that ohm’s law holds for a broad class of materials and range of currents as long as the temperature of the conductor does not change appreciably but that it does not hold for many devices including semiconductors.

Be able to state that current flows into the higher voltage side of a resistor and flows out of the lower voltage side.

Be able to state that currents in the human body as low as 0.015 a can cause muscular contractions making it impossible for a person to remove himself from the voltage source.

Be able to state that currents in the human chest as low as 0.070 a can cause fibrillation of the heart muscle and can cause death.

Be able to distinguish between ac and dc current.

Be able to state that semiconductor diodes offer low resistance in one direction and high resistance in the opposite direction.

Be able to explain how a semiconductor diode can convert ac current to dc current plus a ripple current.

Be able to describe what is meant by drift velocity of electrons in a conductor and state that in metals it is about 10^{-4} m/s.

Be able to explain that when a voltage is applied to a metal an electromagnetic wave travels in the wire at near the speed of light causing electrons along the wire to begin to drift almost immediately.

Be able to calculate electric power given two of the three quantities, current I, voltage V and resistance R. \( P = I V = I^2 R = \frac{V^2}{R} \).

Be able to solve simple problems involving power P, current I, voltage V and resistance R.

Be able to solve simple problems relating the energy supplied U, the power P and the time t. \( U = PT \)

Be able to recognize when elements of a circuit are connected in series.

Be able to calculate the resistance of a series combination of resistors. \( R = R_1 + R_2 \)

Be able to state that the current through each element in a series circuit is the same and that the total voltage across a series circuit is the sum of the voltages across each element.

Be able to place an ammeter in a circuit so as to measure the current in it.

Be able to place a voltmeter across an element so as to measure the voltage across it.

Be able to state that the total current flowing into in a parallel combination circuit is the is the sum of the currents through each branch and that the voltage across each branch in a parallel combination is the same.

Be able to state that in most lighting and power receptacle circuits the lights and receptacles are connected in parallel.

Be able to explain that a fuse or circuit breaker is placed in series with a parallel combination of elements to limit the current flowing in the circuit.

Be able to calculate the resistance of a parallel combination of resistors. \( \frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} \)

Be able to calculate the power consumed in series and parallel circuits.