AP Electricity topics and objectives

**Electric Circuits (7%)**

**Current, resistance, power**

Students should understand the definition of electric current, so they can relate the magnitude and direction of the current to the rate of flow of positive and negative charge.

Students should understand conductivity, resistivity, and resistance, so they can:

(1)  Relate current and voltage for a resistor.

(2)  Write the relationship between electric field strength and current density in a conductor, and describe, in terms of the drift velocity of electrons, why such a relationship is plausible.

(3)  Describe how the resistance of a resistor depends upon its length and cross-sectional area, and apply this result in comparing current flow in resistors of different material or different geometry. (4) Apply the relationships for the rate of heat production in a resistor.

**Steady-state direct current circuits with batteries and resistors only**     
  
Students should understand the behavior of series and parallel combinations of resistors, so they can:     
  
(1) Identify on a circuit diagram whether resistors are in series or in parallel.

(1)  Determine the ratio of the voltages across resistors connected in series or the ratio of the currents through resistors connected in parallel.

(2)  Calculate the equivalent resistance of a network of resistors that can be broken down into series and parallel combinations.

(3)  Calculate the voltage, current, and power dissipation for any resistor in such a network of resistors connected to a single power supply.

(4)  Design a simple series-parallel circuit that produces a given current through and potential difference across one specified component, and draw a diagram for the circuit using conventional symbols.

Students should understand the properties of ideal and real batteries, so they can:

(1)  Calculate the terminal voltage of a battery of specified *emf* and internal resistance from which a known current is flowing.

(2)  Calculate the rate at which a battery is supplying energy to a circuit or is being charged up by a circuit.

Students should be able to apply Ohm’s law and Kirchhoff’s rules to direct-current circuits, in order to:

(1)  Determine a single unknown current, voltage, or resistance.

(2)  Set up and solve simultaneous equations to determine two unknown currents.

Students should understand the properties of voltmeters and ammeters, so they can:

  (1)  State whether the resistance of each is high or low.

  (2)  Identify or show correct methods of connecting meters into circuits in order to measure voltage or current.

**Capacitors in circuits**

Students should understand the *t =*0 and steady-state behavior of capacitors connected in series or in parallel, so they can:

(1)  Calculate the equivalent capacitance of a series or parallel combination.

(2)  Describe how stored charge is divided between capacitors connected in parallel.

(3)  Determine the ratio of voltages for capacitors connected in series.

(4)  Calculate the voltage or stored charge, under steady-state conditions, for a capacitor connected to a circuit consisting of a battery and resistors.