1. (2 pts) You measure the voltage in a household electrical socket to be 120 V (alternating current). What are you measuring?
   a. average voltage
   b. peak voltage
   c. rms voltage
   d. not enough information given

2. (2 pts) Three point charges lie at the vertices of an equilateral triangle as shown. The electric potential energy of the system of the three charges is:
   a. positive
   b. negative
   c. zero
   d. not enough information given

3. (2 pts) The figure shows a surface enclosing the charges 3q and −q. What is the net flux through the surface surrounding the two charges?
   a. q/ε₀
   b. 0
   c. q/ε₀
   d. 3q/ε₀
   e. 3q/ε₀
   f. 4q/ε₀

4. (2 pts) Two light bulbs operate at 120 V, but one has a power rating of 60 W while the other has a power rating of 75 W. Which one has the smaller resistance?
   a. 60 W bulb
   b. 75 W bulb
   c. both have the same resistance
   d. not enough information given

5. (2 pts) Placing a dielectric between the plates of a capacitor will:
   a. increase the capacitance
   b. decrease the capacitance
   c. have no effect on the capacitance

6. (2 pts) Electricity is run through a coil. Another coil is placed near the first coil. What type of electricity will produce a current in the second coil?
   a. Alternating current
   b. Direct current
   c. Both alternating and direct current
   d. Neither alternating or direct current

7. (4 pts) Four charges are placed as shown. Determine the electric field at the origin (magnitude and direction).

8. (14 pts) Two 1.5x10⁻⁵ kg insulated spheres are suspended using insulating thread. The spheres are given an equal charge such that they repel and deflect as shown. Determine the magnitude of the charge on each sphere.

   ![Diagram of two charged spheres with threads showing deflection]

   - 1 Math Error (me)
   - 1 used 0.2 instead of 0.02
   - 1 didn't use Coulomb's law

9. (14 pts) Dry air will support a maximum electric field strength of about 3.0x10⁶ N/C. Above that value, the field creates enough ionization in the air to make the air a conductor. This allows a discharge or spark that reduces the field. Determine the closest two parallel conducting plates can be that have an electric field difference of 45 kV without producing a spark.

   ![Diagram of two parallel plates with electric field arrows]
10. (14 pts) Determine R such that the current flowing through the resistor R is 0.5 amps.

\[ R = 14 \Omega \]

\[ I = \frac{14}{60 + 20} = 10 \Omega \]

\[ V = I \times R = 60 \times 0.5 = 30 \text{ V} \]

12. (14 pts) An electron with a velocity of \( 6.0 \times 10^6 \text{ m/s} \) moves through a magnetic field of \( 24 \text{ fT} \mu \text{T} \). Determine the acceleration of the electron (magnitude and direction).

\[ F = q (v \times B) \]

\[ F = (1.6 \times 10^{-19} \text{ C})(24 \times 10^{-6} \text{ T}) \]

\[ F = 1.73 \times 10^{-15} \text{ N} \]

13. (14 pts) Determine the current, \( I_1 \), through the 8Ω resistor.

\[ R = 12 \text{ Amp} \]