PHY 167 Recitation 4

Chapters 16 - 25 Review.

May 5, 2019

+17.0 μC

15.0 cm   15.0 cm

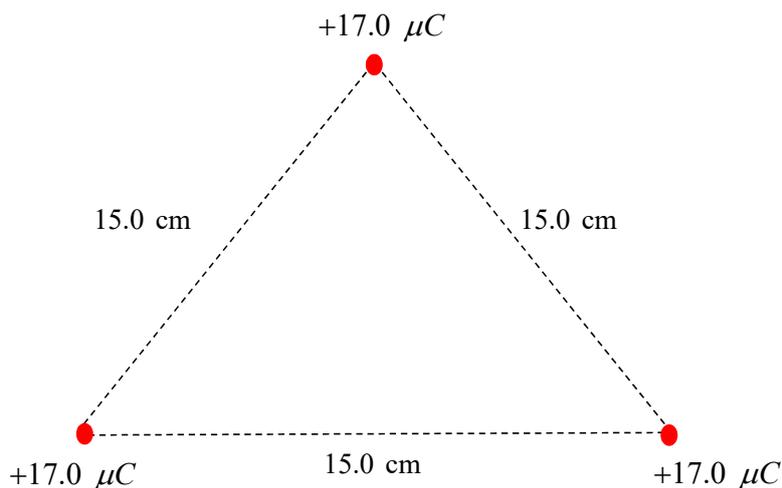+17.0 μC 15.0 cm   +17.0 μC

Figure 1: Figure for problem 1.

1.) Three positive of equal charge, +17 μC, are located at the corners of an equilateral triangle of side 15.0 cm as shown in Figure 1. Calculate the magnitude and direction of the net force on each particle due to the other two.

2.) A +3.5 μC charge is 23 cm to the right of a -7.2 μC charge. At the midpoint between the two charges, **(a.)** Determine the potential and **(b.)** the electric field (both magnitude and direction).
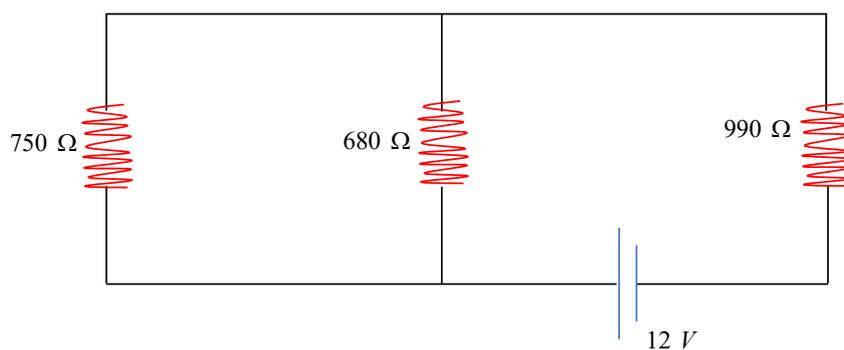
750 Ω   680 Ω   990 Ω

12 V

Figure 2: Figure for problem 3.

3.) Determine **(a.)** the equivalent resistance of the circuit shown in Figure 2, **(b.)** the voltage across each resistor and **(c.)** the current through each resistor.

4.) Determine the magnitudes and directions of the currents in each resistor in Figure 3 for each case: **(a.)** Ignoring internal resistance of the batteries and **(b.)** Assume each battery has an internal resistance of $r = 1.0\,\Omega$.
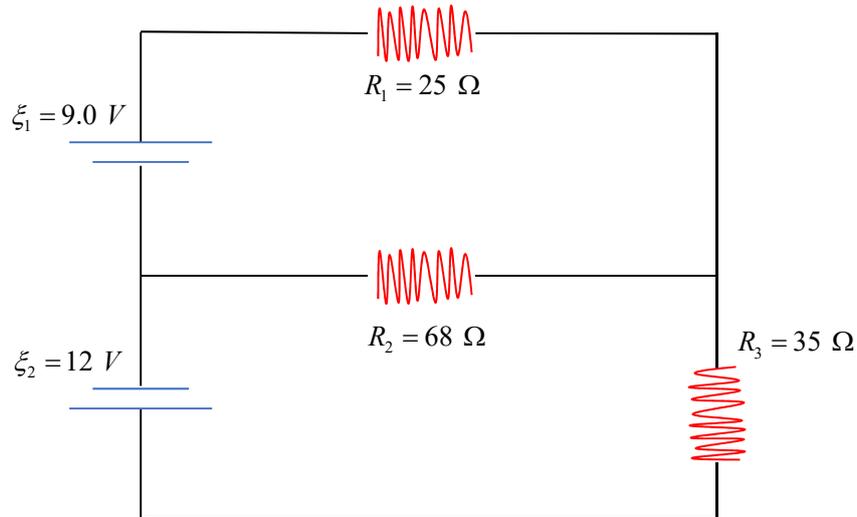
Figure 3: Figure for problem 4.

5.) Two long straight parallel wires are 15 cm apart. Wire A carries a 2.0-A current. Wire B's current is 4 A in the same direction. **(a.)** Determine the magnetic field magnitude due to wire A at the position of wire B. **(b.)** Determine the magnetic field due to wire B at the position of wire A. **(c.)** Are these two magnetic fields equal and opposite? Why or why not? **(d.)** Determine the force on wire A due to wire B, and the force on wire B due to wire A. Are these two forces equal and opposite? Why or why not?

6.) A 600-turn solenoid, 25 cm long, has a diameter of 2.5 cm. A 14-turn coil is wound tightly around the center of the solenoid. If the current in the solenoid increases uniformly from 0 to 5.0 A in 0.6s, what will be the induced emf in the short coil during this time?

7.) What is the wavelength of a 22.75×10^9 Hz radar signal? What is the frequency of an X-ray with wavelength 0.12 nm?

8.) A 4.5-cm-tall object is placed 32 cm in front of a spherical mirror. It is desired to produce a virtual image that is upright and 3.5 cm tall. **(a.)** What type of mirror should be used? **(b.)** Where is the image located? **(c.)** What is the focal length of the mirror? **(d.)** What is the radius of curvature of the mirror?

9.) (a.) A 2.4-cm-high insect is 1.3 m from a 135-mm-focal-length lens. Where is the image, how high is it, and what type is it? **(b.)** Repeat for $f = -135$ mm. Sketch a ray diagram for each scenario.

10.) A source produces first-oder lines when incident normally on a 9800-slit/cm diffraction grating at angles 28.8°, 36.7°, 38.6°, and 41.2°. What are the wavelengths?