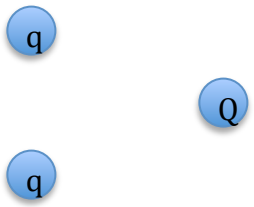
Additional Problems, PHY 1308, Chapter 21:

L2.1) Four charges are at the corners of a square that has 5 cm long sides. All of the charges are positive, q = +1x10^{-6} C. What is the magnitude of the force acting on each charge?

L2.2) Charge Q_1 = -60 nC is at point x=-3.0 mm, and Q_2 = +80 nC is at x=+4.0 mm. If charge q = +30 nC is at the origin, what is the force on this charge? Give the magnitude and angle?

Additional Problems, PHY 1308, Chapter 22:

L3.1) A charge Q of -0.1 μC provides an electric field in a region of space. Imagine a pair of equal charges q that are to the left of Q by -0.1 m and are placed symmetrically such that they are 0.2 m above and below Q in y. What value of q will provide that there is exactly zero electric field at 0.5m to the right of Q.



L3.2) A water molecule acts as a dipole with effective separation 3.9×10^{-12} m. It lies at a distance of 10^{-9} m from a solitary charge of 1 e. What is the force on this isolated charge from the dipole?

L4) One ring of radius a is uniformly charged with charge $+Q$ and is placed so its axis is the x-axis. A second ring with charge $-Q$ is placed concentric with the first and in the same plane. The radius of this ring is $a/2$. If a = 1m and Q = 3μC, what force is exerted on an electron 5m to the right of these along their common axis?

L5) A water molecule has a dipole moment p_d of 6.2×10^{-30} Cm. If p_d is oriented at an angle of 45 degrees from the direction of a uniform electric field, and yields a torque of 4×10^{-20} Nm, what is the magnitude of the electric field?

Additional Problems, PHY 1308, Chapter 23:

L6) For a spherical shell of charge Q = 2 mC distributed with inner and outer radii = 8 and 10 cm, respectively, calculate

a) the electric field at r = 7 cm. Use Gauss's law to motivate your calculation.

b) the electric field at r = 12 cm. Use Gauss's law to motivate your calculation.

Additional Problems, PHY 1308, Chapter 24:

L7) A point charge produces an electric potential as a function of radius $V = kq/r$. Using the rate of change of potential with r, derive the expression for the electric field.

a. What is the electric field value at r = 1 cm if the point charge is an electron?

L8) An ionized hydrogen atom (1 proton = + electron charge) sets up an electric potential of 120 V at distance r. Calculate r and indicate at what distance V = 60 Volts.

Additional Problems, PHY 1308, Chapter 25:

L9) A circuit is comprised of a voltage source of 120 V, and an array of three capacitors, C_1, C_2 and C_3. C_2 and C_3 are in series with each other, and are in parallel with C_1. C_1, C_2 and C_3 are all equal. Connecting this set of capacitors to the battery deposits 0.2 nC of charge cumulatively on all the capacitors. What is C_3?

L10) Consider two parallel plate capacitors each with area 1 cm^2 and separation 1 mm. These capacitors are placed in series under a power source giving 120 V. What is the energy stored on each capacitor?

Additional Problems, PHY 1308, Chapter 26:

L11) Carbon is in the semiconductor category of materials and has a range of resistivities. A resistor made of carbon has a resistivity of 60×10^{-5} Ωm. The resistor itself is 2 cm long and has a cross-sectional area of 4 mm^2. What current would flow thru this resistor if it has 120 V across it?

L12) A 60 W light bulb is powered by a connection to a wall outlet with 120 V across the plug terminals.

a) What is the current passing thru this resistor?

b) An incandescent light bulb is typically 2% efficient, meaning 98% of the power goes to generating heat due to resistance. Calculate this resistance.

c) If a fluorescent lamp has an effective resistance of 210 ohms, what is its efficiency?

Additional Problems, PHY 1308, Chapter 27:

L13) A circuit has an emf of 12 V and internal resistance of 0.1 ohm. The seat of emf is placed across a resistor array that has two sets of three 5 ohm resistors in parallel. These two sets are in series with each other, and with an additional 2 ohm resistor.

a) What is the current thru the 2 ohm resistor?

b) After 2 years of use, the internal resistance grows to 0.5 ohms. What is the current thru the 2 ohm resistor in this case?

L14) A circuit is comprised of a 9 V battery, a switch, a 5 kΩ resistor and a capacitor. When we close the switch, current flows thru the circuit. If it takes 1 second to charge the capacitor to 75% of its maximum, what is its capacitance?

Additional Problems, PHY 1308, Chapter 28:

L15) A proton travels with velocity 30,000 km/s from the Sun towards the Earth. Consider the approximation where the Earth's magnitice field, which is 60 μT near Earth's surface, is approximated as a uniform field for the first 100 km above the surface. The Earth's magnetic field would be pointed Southward. Under these approximations, answer the following.

a) What is the magnitude of the force exerted on the proton?

b) What direction is this force?

L16) Above the ground, a 1 m long wire is suspended horizontally perpendicular to a line running from its center to a nearby observer. A uniform magnetic field of 1.8 Tesla permeates the volume occupied by this wire in the upward direction.

a) If a current of 5×10^{-2} A is passed thru the wire, what is the force on the wire?

b) What is its direction?

c) Is there a current that would cause the wire to move to and hit the observer? If so, describe the configuration.

Additional Problems, PHY 1308, Chapter 29:

L17) A long conducting wire is suspended horizontally above the ground. Let this align with the *x*-axis. A magnetic field of 10^{-3} T is felt at a perpendicular distance of 1 m from the wire. What is the electric current in this wire?

L18) A conducting cylindrical wire has radius of 0.7 mm. What is the magnetic field at a distance of 0.6 mm from the wire axis if 0.25 A passes thru the wire?

Additional Problems, PHY 1308, Chapter 30:

L19) A wire loop attached to an ammeter is near a permanent magnet. The loop is moved so that the magnet passes thru its plane over a 10 sec interval. If the loop encloses an area 2 m^2 and the magnetic field is 10 μT, what is the induced emf when the magnet is half-thru the loop's plane? You may assume a linear change in magnetic flux as the magnet gets to this point.

L20) A 1000 turn inductor has a cross sectional area of 1 cm^2. If 50 μA pass thru it yielding a self-inductance of 0.2 H, what is the magnetic field inside the inductor?

b) What is the energy stored for this inductor?

Additional Problems, PHY 1308, Chapter 32:

L21) Based on the wave equation from Maxwell's Equations, calculate the speed of an electromagnetic wave.

Chapter 33:

L22) A 100 W incandescent light bulb emits light isotropically. Calculate the intensity of the light 0.5 m from the light bulb.

b) What is the energy per cubic meter at this distance?

L23) A block of pyrex (n=1.47) is placed in air and a laser is incident on a flat face of the block. If the angle with respect to the normal is 0.35 radians, what is the angle of incidence?

Additional Problems, PHY 1308, Chapter 34:

L24a) An object 5 cm long is placed a distance 38 cm from the vertex of a spherical mirror having a radius of curvature of 15 cm. Where is the image?

L24b) An object is placed 50 cm in front of a spherical mirror that has a focal length of 20 cm. Calculate the image location.

b) Is the image real or virtual?

c) What is the magnification from this mirror?

L25) A thin lens has a front face and a back face with radii of curvature 17 cm and 24 cm, respectively. The lens is made of flint glass with index of refraction 1.62.

a) What is the focal length of the lens?

b) For an object placed 100 cm in front of the lens, what is the image location?