

# Electrostatics Homework Problems:

## p. 373: #19, 21, 23, 25, 30

Problems taken from the school's old textbook:

Giancoli, D. (1980). *Physics*, 2<sup>nd</sup> Ed. Englewood Cliffs, NJ: Prentice Hall.

Helpful constants:

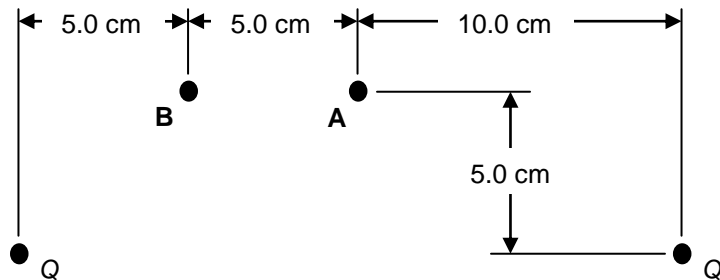
- rest mass of an electron =  $9.11 \times 10^{-31}$  kg
- charge of an electron:  $-1.6 \times 10^{-19}$  C
- charge of a proton:  $1.6 \times 10^{-19}$  C

19. An electron in an electric field experiences a force of  $8.0 \times 10^{-16}$  N. What is the magnitude and direction of the electric field at this point?

21. What is the magnitude and direction of the electric field 12.0 m directly above a  $13 \mu\text{C}$  charge?

23. A proton ( $m_p = 1.67 \times 10^{-27}$  kg) is suspended at rest in a uniform electric field **E**. Take into account gravity and determine **E**. Remember, electric fields are vectors!

25. Determine the net electric field at A and B in the diagram to the right due to the two positive charges ( $Q = 4.0 \mu\text{C}$ ) shown.



30. What is the acceleration of an electron in a 2200 N/C electric field?

### ANSWERS:

19. 5000 N/C; the E-field points in the opposite direction as the force acting on the electron.

21. 813 N/C; the E-field points upward because a positive charge would be repelled by the  $13 \mu\text{C}$  charge which is positive as well.

23.  $1.023 \times 10^{-7}$  N/C; since it is a proton, the E-field must be pointed upward so that the electric force it feels counters the force of gravity.

25. For Point A:  $2.58 \times 10^6$  N/C straight up in the +y direction; for Point B:  $6.69 \times 10^6$  N/C at an angle of  $56.1^\circ$  above what would normally be considered the positive x-axis.

30.  $3.86 \times 10^{14}$  m/s<sup>2</sup>; it will be accelerating in the opposite direction as the E-field since the electron has a negative charge. Note: this acceleration rate will not be sustained – it would quickly reach and exceed the speed of light which is not possible. In reality, the electron would leave the E-field and therefore stop accelerating long before the speed of light was ever reached.