21. A proton and an electron are moving due east in a constant electric field that also points due east. The electric field has a magnitude of 8.0 x 10^4 N/C. Determine the magnitude of the acceleration of the proton and the electron.

$$\sum \overrightarrow{F_x} = q\vec{E} = m\vec{a}$$

Solve for $\vec{a}$

$$\vec{a} = \frac{q}{m}\vec{E}$$

For proton

$$\overrightarrow{a_p} = \frac{q_p}{m_p}\vec{E} = \frac{+e}{m_p}\vec{E} = \left(\frac{1.60\ x\ 10^{-19} C}{1.67\ x\ 10^{-27} kg}\right)\left(8.0\ x\ 10^4\ {}^{N}/_{C}\ \widehat{East}\right)$$

$$\overrightarrow{a_p} = \left(\frac{1.60\ x\ 10^{-19} C}{1.67\ x\ 10^{-27} kg}\right)\left(8.0\ x\ 10^4\ {}^{N}/_{C}\ \widehat{East}\right) = 7.665\ x\ 10^{12}\ {}^{m}/_{s^2}\ \widehat{East}$$

For electron

$$\overrightarrow{a_e} = \frac{q_e}{m_e}\vec{E} = \frac{-e}{m_e}\vec{E} = \left(\frac{-1.60\ x\ 10^{-19} C}{9.11\ x\ 10^{-31} kg}\right)\left(8.0\ x\ 10^4\ {}^{N}/_{C}\ \widehat{East}\right)$$

$$\overrightarrow{a_e} = \left(\frac{1.60\ x\ 10^{-19} C}{9.11\ x\ 10^{-31} kg}\right)\left(8.0\ x\ 10^4\ {}^{N}/_{C}\ -\widehat{East}\right) = 1.405\ x\ 10^{16}\ {}^{m}/_{s^2}\ \widehat{West}$$

$$\overrightarrow{a_p} = 7.7\ x\ 10^{12}\ {}^{m}/_{s^2}\ \widehat{East}$$
$$\overrightarrow{a_e} = 1.4\ x\ 10^{16}\ {}^{m}/_{s^2}\ \widehat{West}$$

Dr. Donovan's Classes Page	**Dr. Donovan's PH 202 Homework Page**
NMU Physics Department Web Page	**NMU Main Page**

Please send any comments or questions about this page to ddonovan@nmu.edu

This page last updated on January 28, 2021