PHY2049 Quiz #1 May 21, 2018

There are two questions in this quiz: one conceptual, and one practical. The conceptual question is multiple choice while **you must show your work for the practical problem for full credit**. Both questions are short and the quiz should take about **5 minutes** or so to complete.

Name: SOLUTIONS

Equations that you may need:

$e = 1.602 \times 10^{-19}$ C $\qquad k = 8.99 \times 10^{9} \dfrac{\text{Nm}^2}{\text{C}^2}$

$Q = (N_p - N_e)e \qquad F_e = k\dfrac{q_1 q_2}{r^2}$

$F = qE \qquad E = k\dfrac{q}{r^2}$

1. Consider a charge q_A producing an electric field. A second charge q_B feels the electric field with a magnitude E. If the distance between q_A and q_B is doubled, and the charge q_B is halved, what is the new value of the electric field felt by q_B?

   (a) $E/8$
   (b) $E/4$
   (c) $E/2$
   (d) E

$E = k\frac{q_A}{r^2}$ ← q_A IS THE PRODUCING CHARGE.

IF r IS DOUBLED, $E' = k\frac{q_A}{(2r)^2} = \frac{1}{4}k\frac{q_A}{r^2} = \frac{E}{4}$

IF q_B IS HALVED, NO EFFECT ON E!!

2. If the electric force between an electron and a charged substance is 1.5×10^{-20} N when separated by 1m, how many excess electrons does the substance have?

$F = k\frac{qQ}{r^2} \Rightarrow Q = \frac{r^2 F}{kq} = \frac{(1)^2(1.5\times10^{-20})}{(8.99\times10^{9})(1.6\times10^{-19})}$

$= 1.04\times10^{-11}$ C

Excess electrons: $Q = Ne$

$\Rightarrow N = \frac{Q}{e} = \frac{(1.04\times10^{-11})}{(1.6\times10^{-19})}$

$= \boxed{6.52\times10^{7} \text{ electrons}}$