EvaluAIde Beta Bonus Assignment – College Physics II: Electrostatics

Instructions:

- Answer all questions in detail. Show your work and reasoning for each part.
- Your submission must be a single PDF file. You may type your solutions or handwrite and scan them.
- This assignment is for bonus credit and will help improve our grading tools—thank you for participating!
- Submit your PDF via the usual course submission portal by the posted deadline.

ALL ANSWERS ARE AT THE END OF THE PDF WRITTEN OUT

Questions

1. **Coulomb's Law:**
   Two point charges, $q_1 = +2.0\ \mu\text{C}$ and $q_2 = -3.0\ \mu\text{C}$, are placed 0.50 m apart in vacuum.
   a) Calculate the magnitude and direction of the electrostatic force on each charge.
   b) Is the force attractive or repulsive?

2. **Electric Field of a Point Charge:**
   What is the magnitude and direction of the electric field at a point 0.30 m away from a $+5.0\ \mu\text{C}$ point charge?

3. **Electric Field from Multiple Charges:**
   Two charges, $+1.0\ \mu\text{C}$ and $-2.0\ \mu\text{C}$, are fixed 0.40 m apart.
   a) Find the electric field at the midpoint between them (magnitude and direction).
   b) If a $+1.0$ nC test charge is placed at the midpoint, what force does it experience (magnitude and direction)?

4. **Electric Potential (Point Charges):**

What is the electric potential at a point 0.25 m from a $-4.0\ \mu C$ point charge? (Assume zero potential at infinity.)

5. **Potential Difference and Work:**

An electron moves from point A (potential = +100 V) to point B (potential = −50 V).

a) What is the potential difference $V_B - V_A$?

b) How much work is done by the electric field on the electron during this move?

Questions

1. a) Magnitude = 0.257 N

Direction = pull toward each other

$F = k \cdot \left| \frac{q_1 \cdot q_2}{r^2} \right|$

$8.99 \times 10^9 \cdot \frac{(2.0\times10^{-6})(3.0\times10^{-6})}{(.50)^2}$

$F = 0.2157\ N$

(+), (−) = attraction

q_1 directed towards q_2

q_2 directed towards q_1

b) attractive since charges are opposite

2. Magnitude: 5.0×10^5 N/C

$E = k\frac{|q|}{r^2} \Rightarrow 8.9875\times10^9 \cdot \frac{|5.0\times10^{-6}C|}{(.30)^2}$

$E = 5.0\times10^5$ N/C

Direction: away from +5.0 μC charge

Charge = (+) = points away

3. a) 6.7×10^5

Direction: towards −2.0 μC charge to the right

Midpoint = D/2 = .20m from each

$E_1 = k\frac{|q_1|}{r^2} = 8.9875\times10^9 \times \frac{(1.0\times10^{-6})}{(.20m)^2} = 224687.5$ N/C

$E_2 = k\frac{|q_2|}{r^2} = 8.9875\times10^9 \times \frac{|2.0\times10^{-6}|}{(.20m)^2} = 449375$ N/C

$E_{net} = E_1 + E_2 = 674062.2$ N/C

b) 6.7×10^{-4} N right

b) $F = q_{test} E_{net}$

$q_{test} = 1.0nC = 1.0\times10^{-9}C$

$F = (1.0\times10^{-9}) \times (674062.2)$

$F = 6.7\times10^{-4}$ N

4. $V = -1.4\times10^5$ V

$V = k\frac{q}{r}$

$V = 8.9875 \cdot \frac{(-4.0\times10^{-6})}{.25} = -143.5808$ V

5. a) −150 V

$V_B - V_A = (-50V) - (+100V) = -150V$

b) 2.40×10^{-17} J

$V_E = q\Delta V$

$W = -q\Delta V$

$-(-1.602\times10^{-19}C)(-150V) = 2.40\times10^{-17}$ J