At least #1,3,5-10,13

PRACTICE EXERCISES

Formulas: $|\vec{E}| = \frac{kq_s}{r^2}$ $\vec{E} = \frac{\vec{F}_e}{q_t}$

Note: Problems on gravitational fields are included for comparison.

1. What is the magnitude of the electric field strength 7.50×10^{-1} m from an 8.00 μC point charge?

$$E = \frac{K(8\times10^{-6})}{(0.75)^2} = \underline{1.28\times10^5 \frac{N}{C}}$$ ✓

2. Calculate the magnitude of the gravitational field strength on the surface of Mars. Mars has a radius of 3.43×10^6 and a mass of 6.37×10^{23} kg.

√

$$\cancel{m}g = \frac{GM\cancel{m}}{r^2}$$

$$g = \frac{G(6.37\times10^{23}\,kg)}{(3.43\times10^6)^2} = \underline{3.61 \frac{N}{kg}}$$ ✓

3. At a point, a short distance from a 4.60×10^{-6} C point charge, there is an electric field strength of 2.75×10^5 N/C. What is the distance to the point charge producing this field?

$$r = \sqrt{\frac{Kq}{E}} = \sqrt{\frac{9\times10^9(4.6\times10^{-6})}{2.75\times10^5}} = \underline{0.388\ m}$$ ✓

4. On the surface of Planet X an object has a weight of 63.5 N and a mass of 22.5 kg. What is the magnitude of the gravitational field strength on the surface of Planet X?

$$F = mg \quad g = \frac{F}{m} = \frac{63.5N}{22.5kg} = \underline{2.82 \frac{N}{kg}}$$ ✓

$\text{Helium} = 2p + 2n = \cancel{2(1.6\times10^{-19}\,C)} = 2p = q_{He} = 2q_p$

5. ✓ If an alpha particle experiences an electric force of 0.250 N at a point in space, what electric force would a proton experience at the same point?

F_{He} q_p

$E = \frac{F}{q}$ $\frac{F_p}{q_p} = \frac{F_{He}}{q_{He}}$ $F_p = \frac{q_p F_{He}}{q_{He}} = \frac{q_p(0.25\,N)}{2q_p}$

$F = Eq$

$F \propto q$

$= \underline{0.125\,N}$ ✓

6. What is the magnitude of the electric field strength at a point in space where a 5.20×10^{-6} C point charge experiences an electric force of 7.11×10^{-3} N?

$E = \frac{F}{q} = \frac{7.11\times10^{-3}\,N}{5.2\times10^{-6}\,C} = \underline{1.37\times10^{3}\,\frac{N}{C}}$ ✓

7. What is the initial acceleration of an alpha particle when it is placed at a point in space where the magnitude of the electric field strength is 7.60×10^{4} N/C?

$= 2(1.6\times10^{-19})$

$F = Eq = ma$

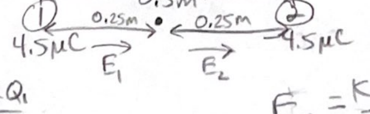
$a = \frac{Eq}{m} = \frac{(7.6\times10^{4}\,N/C)(2(1.6\times10^{-19}))}{6.65\times10^{-27}}$

$= \underline{3.65\times10^{12}}\,m/s^2$ ✓

mistake on direction in key diagram

8. Calculate the magnitude of the electric field strength mid-way between a 4.50 μC charged object and a –4.50 μC charged object if the two charged objects are 5.00×10^{-1}m apart.

$\vec{E}$ direction + charge would move at that point

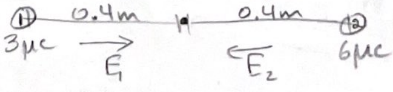


$E_{tot} = 6.48\times10^{5} + 6.48\times10^{5} = \underline{1.30\times10^{6}\,N/C}$

$E_1 = \frac{KQ_1}{r^2} = \frac{(9\times10^{9})(4.5\times10^{-6})}{(0.25)^2} = 6.48\times10^{5}$

$E_2 = \frac{KQ_2}{r^2} = \frac{(9\times10^{9})(4.5\times10^{-6})}{(0.25)^2}\,[rt] = 6.48\times10^{5}$ [rt]

9. Calculate the magnitude of the electric field strength mid-way between a 3.0 μC point charge and a 6.0 μC point charge if the objects are 8.0×10^{-1} m apart.



$E_1 = \frac{KQ_1}{r^2} = \frac{k(3\times10^{-6})}{(0.4)^2} = 1.6875\times10^{5}\,[rt]$

$E_2 = \frac{KQ_2}{r^2} = \frac{k(6\times10^{-6})}{(0.4)^2} = 3.375\times10^{5}\,[lf]$

$E_2 - E_1 = \underline{1.7\times10^{5}\,N/C}$ [lf] ✓

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10. Calculate the magnitude of the el
they are 9.0×10^{-1} m apart.

charges =

distance =

Ⓕ 3μ

Ele

11. What is the magnitude of the elec
an initial acceleration of 7.50×1

$F = ma$

$= (9.11\times10^{-3}$

$= 6.832$

12. The electric field strength at a dis
What is the electric field strength

$E = \frac{kq}{r^2}$

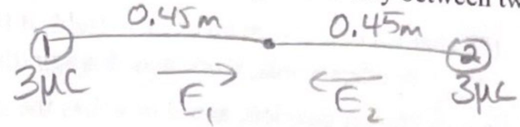
13. At a distance of 7.50×10^{-1} m fr
$E_1 = 2.10\times10^{4}$ N/C. At what distance
strength be 4.20×10^{4} N/C? $= E_2$

r_1

$\frac{r_2^2}{r_1^2} = \frac{E_1}{E_2}$

$r_2 = \sqrt{\frac{r_1}{}}$

10. Calculate the magnitude of the electric field strength mid-way between two 3.0 μC point charges if they are 9.0×10^{-1} m apart.



charges =
distance =

Electric fields will cancel out

$E_{net} = 0$ ✓

11. What is the magnitude of the electric field strength at a point in space where an electron experiences an initial acceleration of 7.50×10^{12} m/s²?

$F = ma$

$= (9.11\times10^{-31}\,kg)(7.5\times10^{12}\,m/s^2)$

$= 6.8325\times10^{-18}\,N$

$E = \frac{F}{q} = \frac{6.8325\times10^{-18}}{1.6\times10^{-19}}$

$= 4.27\times10^{1}$

$= 42.7\,N/C$ ✓

12. The electric field strength at a distance of $\overset{=r_1}{3.00\times10^{-1}}$ m from a point charge is 3.60×10^{5} N/C. $= E_1$ What is the electric field strength at a distance of $\underset{=r_2}{4.50\times10^{-1}}$ m from the same point charge?

$E = \frac{kq}{r^2}$

$\frac{E_2}{E_1} = \frac{r_1^2}{r_2^2}$ ✓

$E_2 = E_1\frac{r_1^2}{r_2^2} = 3.6\times10^{5}\times\frac{0.3^2}{0.45^2} = 1.6\times10^{5}\,\frac{N}{C}$

13. At a distance of $\overset{r_1}{7.50\times10^{-1}}$ m from a small charged object the electric field strength is $E_1 = 2.10\times10^{4}$ N/C. At what distance from this same object would the magnitude of the electric field strength be 4.20×10^{4} N/C? $= E_2$

$\frac{r_2^2}{r_1^2} = \frac{E_1}{E_2}$

$r_2 = \sqrt{\frac{r_1^2 E_1}{E_2}} = \sqrt{\frac{(.75m)^2(2.1\times10^4\,N/C)}{4.2\times10^4\,N/c}}$

$= 5.3\times10^{-1}\,m$ ✓