8. Electric Charges, Fields, and Gauss's Law

Starter Quiz ·

AP Physics C: Electricity and Magnetism Name: _____ Score: _____

1. Two negative charges are brought near each other. They:

   ☐ become neutral

   ☐ repel

   ☐ do nothing

   ☐ attract

2. When you charge an object, what actually moves?

   ☐ new charge is created

   ☐ the nucleus

   ☐ electrons

   ☐ protons

3. The electric field at a point is the:

   ☐ total charge there

   ☐ energy per second

   ☐ speed of a charge

   ☐ force per unit charge there

4. Linear charge density λ has units of:

   ☐ C

   ☐ $\mathrm{C/m^3}$

   ☐ $\mathrm{C/m^2}$

   ☐ C/m

5. Electric flux through a flat area is:

   ☐ $EA\sin\theta$

   ☐ E/A

   ☐ $E + A$

   ☐ $EA\cos\theta$

6. A charge outside a closed surface adds to the net flux through it.

   ☐ True ☐ False

7. Two $+3\ \mu$C charges are 2 m apart. Find the force (in N). Use $k = 9 \times 10^9$.

   _____ N

8. Charging by conduction (direct contact) leaves the object with the opposite sign to the source.

   ☐ True ☐ False

9. Find the field (in N/C) 3 m from a +6 nC charge. Use $k = 9 \times 10^9$.

   _____ N/C

10. The field from a small element dq at distance r is $dE = k\,dq/$ _____.

    _____

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Answers ·

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1. **repel**

   Like charges repel – two negatives push apart.

2. **electrons**

   Charging moves electrons; protons stay locked in the nuclei.

3. **force per unit charge there**

   $\vec{E} = \vec{F}/q$ – the force a unit positive charge would feel.

4. **C/m**

   $\lambda = dq/d\ell$ is charge per length, C/m.

5. $EA\cos\theta$

   $\Phi = \vec{E}\cdot\vec{A} = EA\cos\theta$, with θ from the normal.

6. **False**

   False. Field lines from an outside charge enter and leave the surface equally, so the net flux is zero; only enclosed charge counts (Gauss's law).

7. **0.02 N**

   $F = \dfrac{(9\times10^{9})(3\times10^{-6})^{2}}{2^{2}} = \dfrac{9\times10^{9}\cdot 9\times10^{-12}}{4} \approx 0.02$ N.

8. **False**

   False. Contact shares charge, so both objects end with the same sign. Opposite charge comes from charging by induction.

9. **6 N/C**

   $E = \dfrac{(9\times10^{9})(6\times10^{-9})}{3^{2}} = \dfrac{54}{9} = 6$ N/C.

10. **r^2**

    Each element is a point charge: $dE = k\,dq/r^{2}$.