

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

Starter Quiz · 课前小测

AP Physics C: Electricity and Magnetism

Name: _____ Score: _____

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

- ☐ attract
- ☐ repel
- ☐ do nothing
- ☐ become neutral

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

- ☐ protons
- ☐ electrons
- ☐ the nucleus
- ☐ new charge is created

3. The electric field at a point is the:

- ☐ force per unit charge there
- ☐ total charge there
- ☐ energy per second
- ☐ speed of a charge

4. Linear charge density λ has units of:

- ☐ C/m^3
- ☐ C/m^2
- ☐ C/m
- ☐ C

5. Electric flux through a flat area is:

- ☐ $EA \cos \theta$
- ☐ $EA \sin \theta$
- ☐ E/A
- ☐ $E + A$

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

_____ N

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

_____ N/C

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

9. A field $E = 100 \text{ N/C}$ passes straight through ($\theta = 0$) an area of 2 m^2 . Find the flux ($\text{N} \cdot \text{m}^2/\text{C}$).

_____ $\text{N} \cdot \text{m}^2/\text{C}$

10. A charge outside a closed surface adds zero net flux through it.

- ☐ True ☐ False

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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. **0.02 N**

$$F = \frac{(9 \times 10^9)(3 \times 10^{-6})^2}{2^2} = \frac{9 \times 10^9 \cdot 9 \times 10^{-12}}{4} \approx 0.02 \text{ N}.$$

7. **6 N/C**

$$E = \frac{(9 \times 10^9)(6 \times 10^{-9})}{3^2} = \frac{54}{9} = 6 \text{ N/C}.$$

8. **r^2**

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

9. **$200 \text{ N} \cdot \text{m}^2/\text{C}$**

$$\Phi = EA \cos 0 = 100 \times 2 \times 1 = 200.$$

10. **True**

Outside charge sends in as much flux as it takes out — net zero.