

Electric Fields

PH11-11

ORIENTATION

Lesson goal: describe electric fields using field lines, field strength, potential difference, and field-force relationships.

Electric field diagrams are representations of force per unit positive test charge. They are not paths taken by electrons.

CORE CONTENT

Electric field strength is force per unit charge:

$$E = \frac{F}{q}$$

For a point charge:

$$E = k \frac{|Q|}{r^2}$$

Potential difference is energy transferred per unit charge:

$$V = \frac{W}{q}$$

REPRESENTATION	MEANING
field-line direction	force direction on a positive test charge
closer field lines	stronger field
uniform field	constant magnitude and direction, often between parallel plates
equipotential	locations with equal electric potential

CONCEPT CHECK

1. Electric field strength is:

- A. force per unit positive charge
- B. charge per unit time
- C. energy per kilogram
- D. resistance per metre

Answer: A.

2. Electric field lines point in the direction of force on:

- A. a neutron
- B. a positive test charge
- C. an electron only
- D. a magnetic pole

Answer: B.

3. Closer field lines usually indicate:

- A. weaker field
- B. stronger field
- C. zero potential
- D. no force

Answer: B.

APPLIED PRACTICE

A charge experiences a force of 0.18 N in an electric field. The charge is 3.0×10^{-6} C. Calculate the electric field strength.

$$E = \frac{F}{q} = \frac{0.18}{3.0 \times 10^{-6}} = 6.0 \times 10^4 \text{ N C}^{-1}$$

Final answer: $6.0 \times 10^4 \text{ N C}^{-1}$.

DEEP PRACTICE AND WRITING

Prompt: explain why field lines around a positive point charge point outward and why their spacing changes with distance.

MAINTENANCE LOOP

State field definition, field-line direction, and what field-line density represents.

STUDENT WORKING
