

Exercise walk-through

10.3

Electric Fields

AP Physics 2

Electric fields and field lines

The **electric field** is force per unit positive charge:

Field of a point charge

$$\vec{E} = \frac{\vec{F}}{q}, \quad E = k \frac{q}{r^2}$$

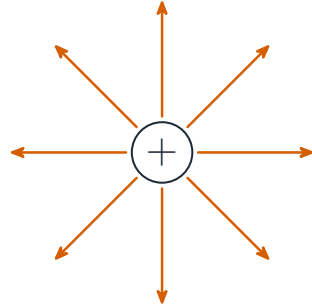
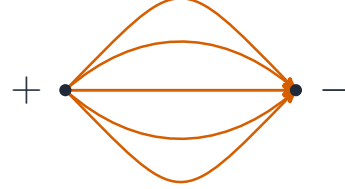
- lines leave +, enter -; denser = stronger
- a **uniform field** sits between parallel plates



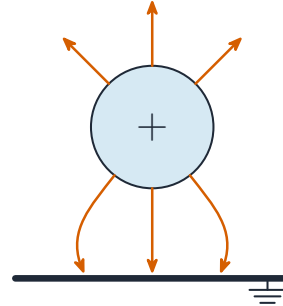
Charges create electric fields in space

Electric field-line patterns for parallel plates

a) parallel plates (uniform field) b) dipole (+ and -)



c) point charge (radial)



d) sphere above earthed plate

Electric field-line patterns for parallel plates, a dipole, and a point charge

Exercises 2.1-2.3

2.1 A charge of 2.0×10^{-6} C feels a force of 0.10 N. Find the electric field there. [2]

2.2 State the direction of the field around a positive point charge. [1]

2.3 Find the field 0.20 m from a $+4.0 \mu\text{C}$ charge ($k = 8.99 \times 10^9$). [2]

Exercises 2.1-2.3

2.1 A charge of 2.0×10^{-6} C feels a force of 0.10 N. Find the electric field there. [2]

2.1

- $$E = \frac{F}{q} = \frac{0.10}{2.0 \times 10^{-6}} = 5.0 \times 10^4 \text{ N C}^{-1}$$

2.2 State the direction of the field around a positive point charge. [1]

2.2

- radially outward, away from the charge

2.3 Find the field 0.20 m from a $+4.0 \mu\text{C}$ charge ($k = 8.99 \times 10^9$). [2]

2.3

- $$E = k \frac{q}{r^2} = 8.99 \times 10^9 \times \frac{4.0 \times 10^{-6}}{(0.20)^2} = 9.0 \times 10^5 \text{ N C}^{-1}$$

Exercises 3.1-3.2

3.1 The electric field is defined as

[1]

☐

A force $\times$ charge

B force per unit charge

C charge per unit force

D charge $\times$ distance

3.2 Field lines around a negative point charge point

[1]

☐

A away from it

B toward it

C in circles around it

D there are none

Exercises 3.1-3.2

3.1 The electric field is defined as

[1]

☐

A force $\times$ charge

B force per unit charge

C charge per unit force

D charge $\times$ distance

3.1 B

- force per unit charge.

3.2 Field lines around a negative point charge point

[1]

☐

A away from it

B toward it

C in circles around it

D there are none

3.2 B

- toward it.

Exercise 3.3 (a)

3.3 A $+6.0 \mu\text{C}$ charge sits at the origin.

(a) Find the electric field 0.30 m from it.

[3]

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3.3 A $+6.0 \mu\text{C}$ charge sits at the origin.

(a) Find the electric field 0.30 m from it.

[3]

(a)

- $$E = 8.99 \times 10^9 \times \frac{6.0 \times 10^{-6}}{(0.30)^2} = 6.0 \times 10^5 \text{ N C}^{-1}$$

Exercise 3.3 (b)

3.3 A $+6.0 \mu\text{C}$ charge sits at the origin.

(b) State the direction of the field.

[1]

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3.3 A $+6.0 \mu\text{C}$ charge sits at the origin.

(b) State the direction of the field.

[1]

(b)

- away from the charge (radially outward)