Electric fields

Cambridge International AS & A Level Physics

> *Unlike IGCSE, 9702 gives you a data sheet: it is page 2 of Papers 1, 2 and 4, with more formulae on page 3 of Paper 4. Everything marked GIVEN is printed for you; everything else you must recall. Compiled by GioPhysics from the published syllabus. This is an independent study aid, not a Cambridge document; the official syllabus is the authority.*

18.1 Electric fields and field lines

A LEVEL

Force on a charge in a field

$$F = qE$$

- F — force (N)
- q — charge (C)
- E — electric field strength (N C^{-1}, V m^{-1})

18.2 Uniform electric fields

A LEVEL

Field between parallel plates

$$E = V / d$$

- E — field strength (V m^{-1})
- V — potential difference (V)
- d — plate separation (m)

18.3 Electric force between point charges

A LEVEL

Coulomb's law

$$F = Q_1Q_2 / (4\pi\varepsilon_0 r^2)$$

- F — force (N)
- Q_1, Q_2 — the two point charges (C)
- ε_0 — permittivity of free space (F m^{-1})
- r — separation (m)

In free space.

18.4 Electric field of a point charge

A LEVEL

Field due to a point charge

$$E = Q / (4\pi\varepsilon_0 r^2)$$

- E — field strength (V m^{-1})
- Q — point charge (C)

18.5 Electric potential

A LEVEL

Potential due to a point charge

$$V = Q / (4\pi\varepsilon_0 r)$$

- V — electric potential (V)
- Q — point charge (C)

A LEVEL

Electrical potential energy

$$EP = Qq / (4\pi\varepsilon_0 r)$$

EP — potential energy of the pair (J)
Q, q — the two point charges (C)

A LEVEL

Field as potential gradient

$$E = - dV / dx$$

E — field strength (V m^{-1})
dV/dx — potential gradient (V m^{-1})