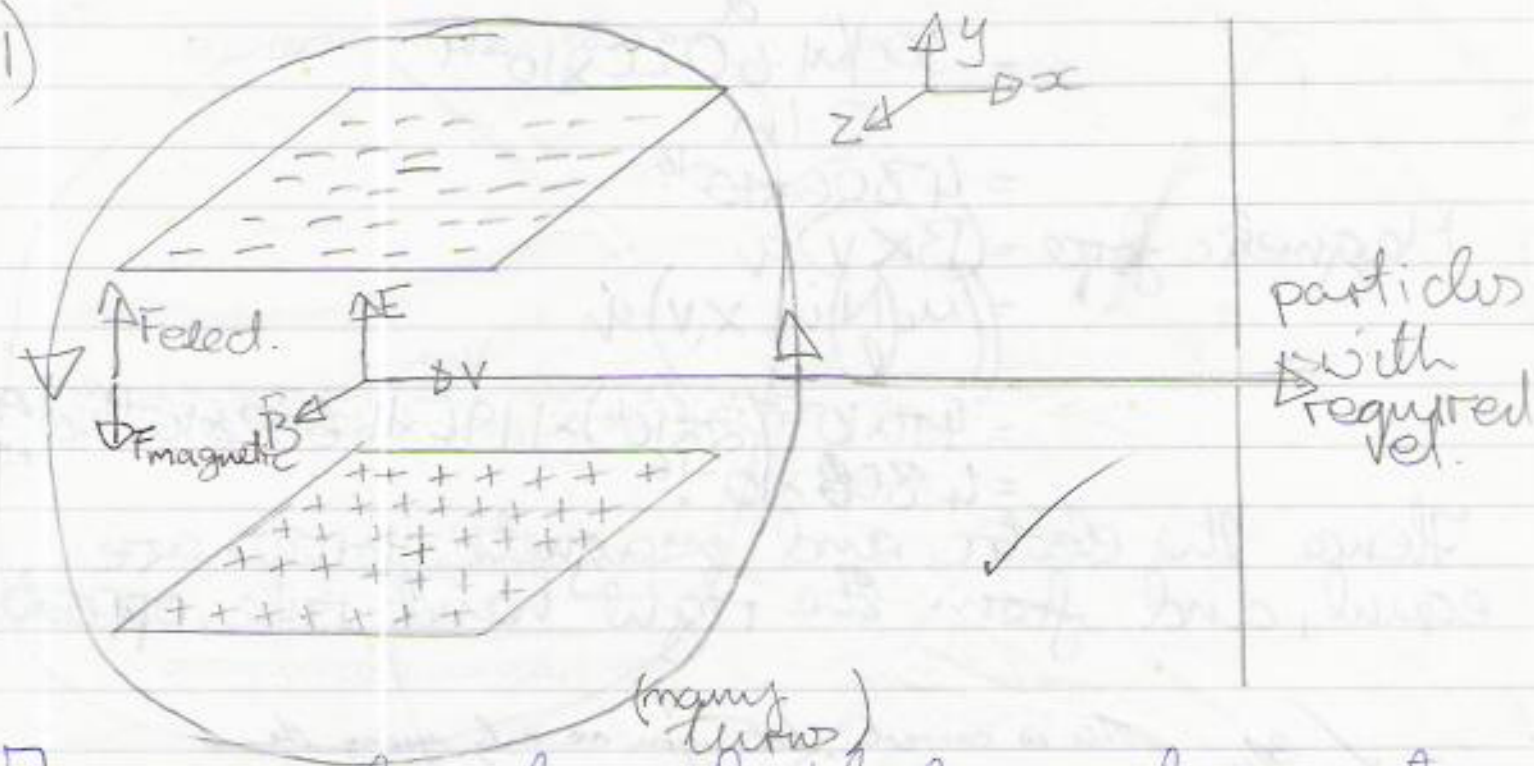
S271 TMA 03

1)



(many turns)

In a combination of electric and magnetic fields, a charged particle experiences a force given by the Lorentz equation

$F = Eq + qB \times V$.

Vector notation needed.

unit 10, p 21

The magnetic field at the centre of a long solenoid is given by $B = \mu_0 \frac{N}{l} i$ ✓

The electric field $E = V/d$. ✓

Not all the known quantities and their values. 7/10.

Consider first the force on the particle

$F = Eq + qB \times V$.

Vector notation needed

If the particle is to pass through undeflected, then the Force must be equal to zero.

$0 = Eq + qB \times V$

$0 = E + B \times V$

The magnetic field B and the direction of the particles are at right angles, hence $B \times V = BV$, and so

$0 = E + BV$

$V = -\frac{E}{B}$.

Since the forces have to cancel out it is a good idea to use magnitudes from here, ie

$qE = qv_0B$

$\therefore v_0 = E/B$