Electric field Continued :.

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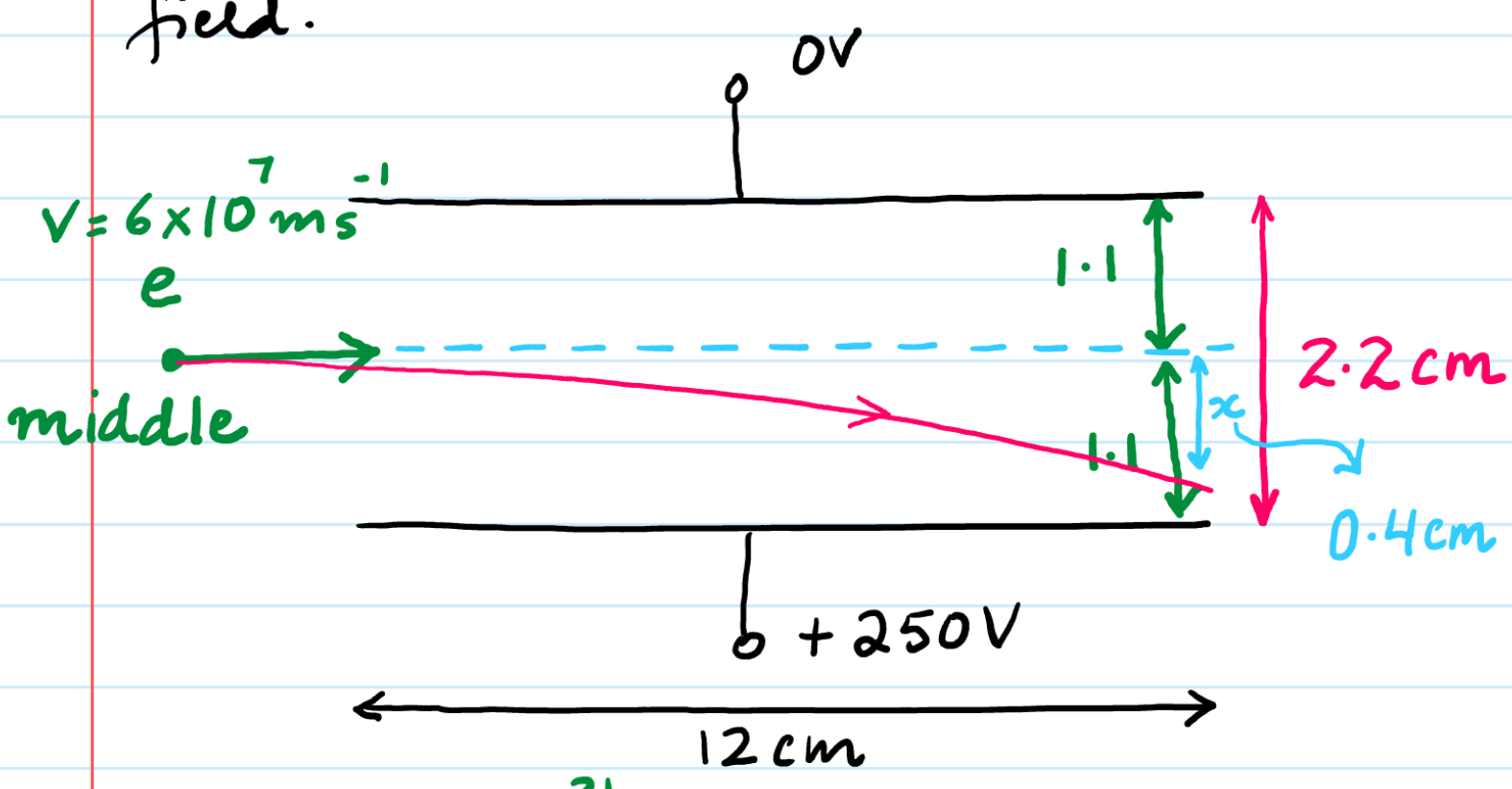
Half Projectile motion for a charged particle in an Electric field.



$m_e = 9.11 \times 10^{-31}$ Kg

$q_e = 1.6 \times 10^{-19}$ C

(i) Cal. Electric field strength b/w the plates

$$E = \frac{V}{d} = \frac{250}{2.2 \times 10^{-2}} = \boxed{11{,}000 \ Vm^{-1}}$$

(ii) Cal. Electric force on this electron

$F = Eq \quad F = (11000)(1.6 \times 10^{-19})$

$$\boxed{F = 1.8 \times 10^{-15} N}$$

(iii) Cal. the acc. of this electron

$F = ma$

$1.8 \times 10^{-15} = (9.11 \times 10^{-31})\, a$

$$\boxed{a = 2 \times 10^{15} \ m/s^2}$$

* exp. why acc due to gravity is not considered

acc (gravity) is negligable as compared to acc (due to Elec. field) hence ignored.

(iv) Cal. the time taken by the electron to travel b/w the plates?

$\longleftrightarrow \quad s = ut + \frac{1}{2}at^2$

$0.12 = (6 \times 10^7) \times t + 0$

$t = 2 \times 10^{-9} \ s$

$\longleftrightarrow \quad d = s \times t$

$0.12 = (6 \times 10^7)\, t$

$t = 2 \times 10^{-9} s.$

(v) Cal. the vertical distance travelled by the electron as it moves b/w the plates?

$\updownarrow \quad s = ut + \frac{1}{2}at^2$

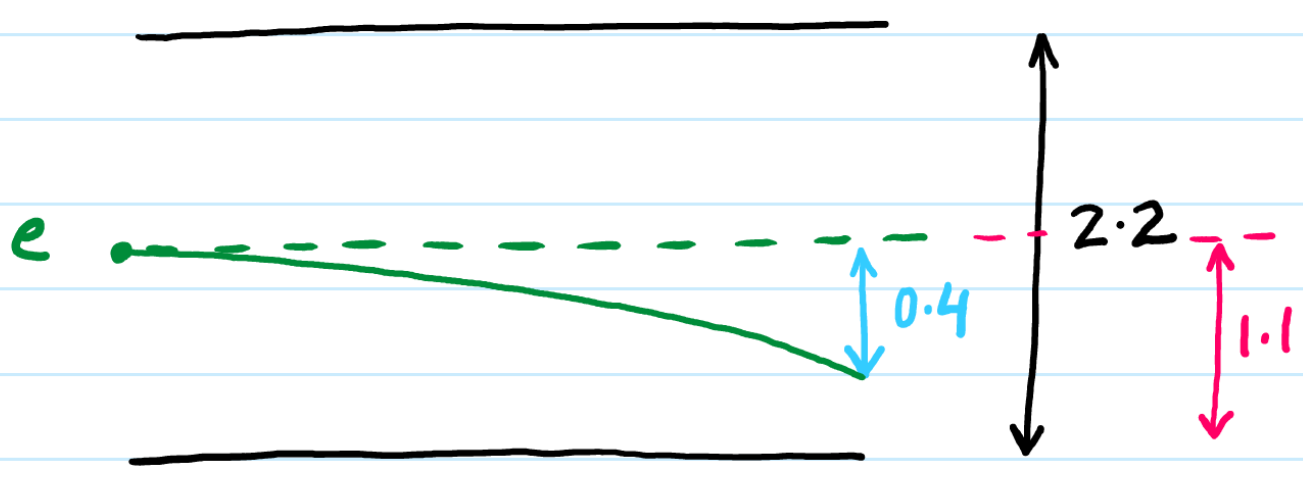
$$y = 0 + \frac{1}{2}(2 \times 10^{15})(2 \times 10^{-9})^2$$

$y = 4 \times 10^{-3}$ (0.004 m) or

$y = 0.4$ cm

(vi) Hence determine with full working, whether this electron strikes the bottom plate OR exits without striking the bottom plate? (6 marks)

(only part asked)



1.1 cm = available distance

0.4 cm = vertical distance fallen

Conclusion 1.1 − 0.4 = 0.7cm

electron will exit from the other side

Reason :. It is still 0.7cm above the bottom plate as it exits the field.