Electric field Continued

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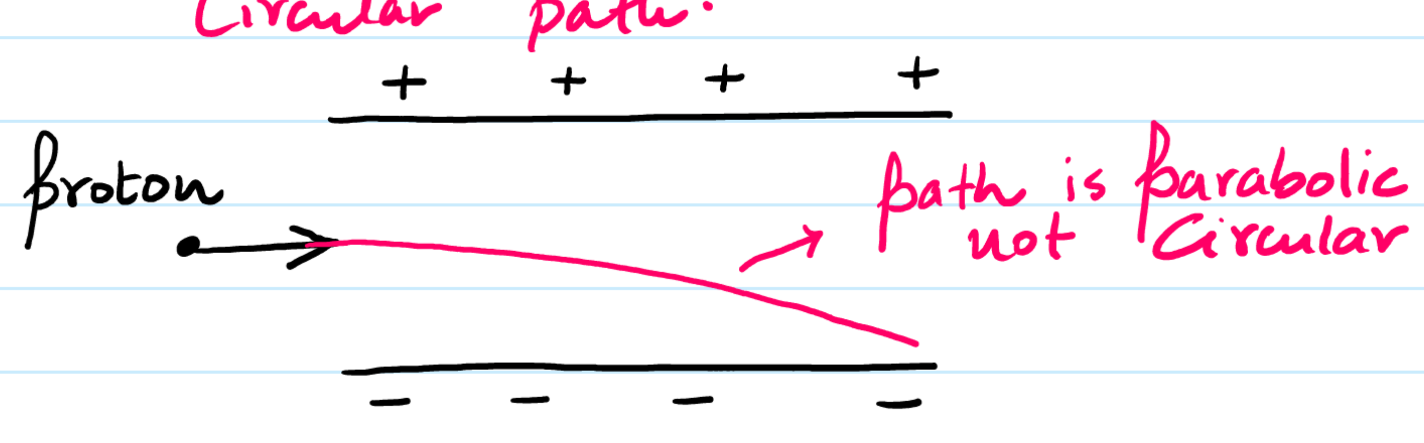
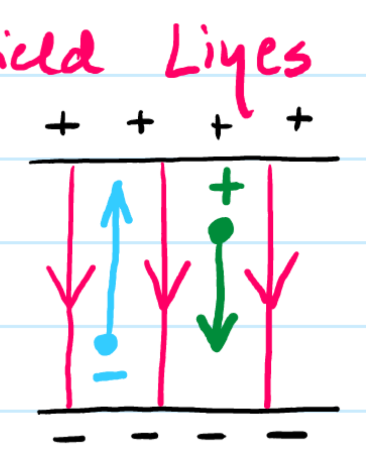
Properties of Electric field

① E.F is capable of applying force on a stationary charge as well as on a moving charge

② A moving charge in an electric field always performs a parabolic path rather than a circular path.



③ The force exerted by the electric field is always parallel to the field lines

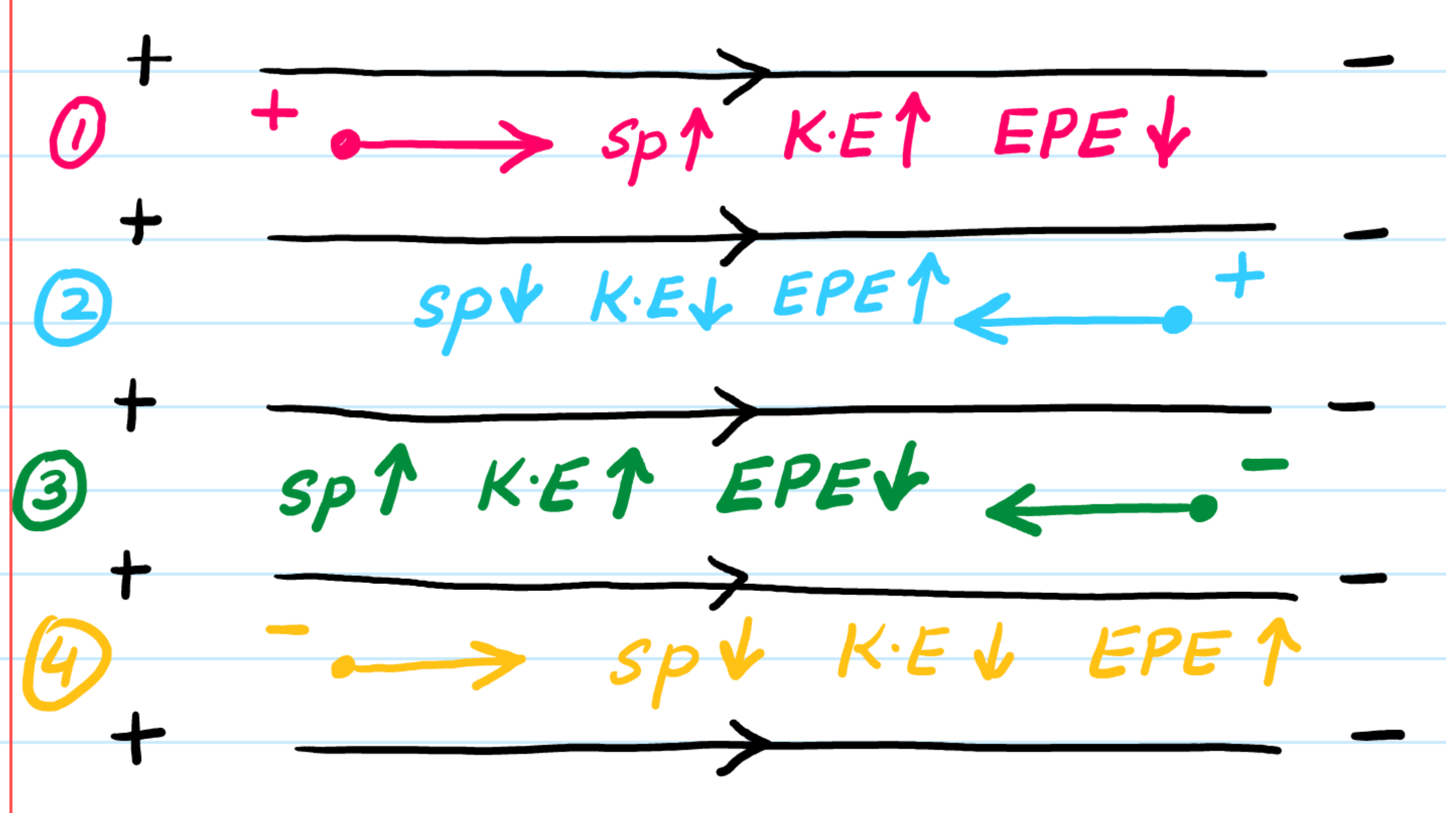


"Conversion of Energy from one form to another in an Electric field"

Mechanics
(G)P.E → K.E or Vice Versa

Electricity
(E)P.E → K.E or Vice Versa
(Electric Potential Energy)

How to calculate E.P.Energy = qV
q = charge
V = Voltage



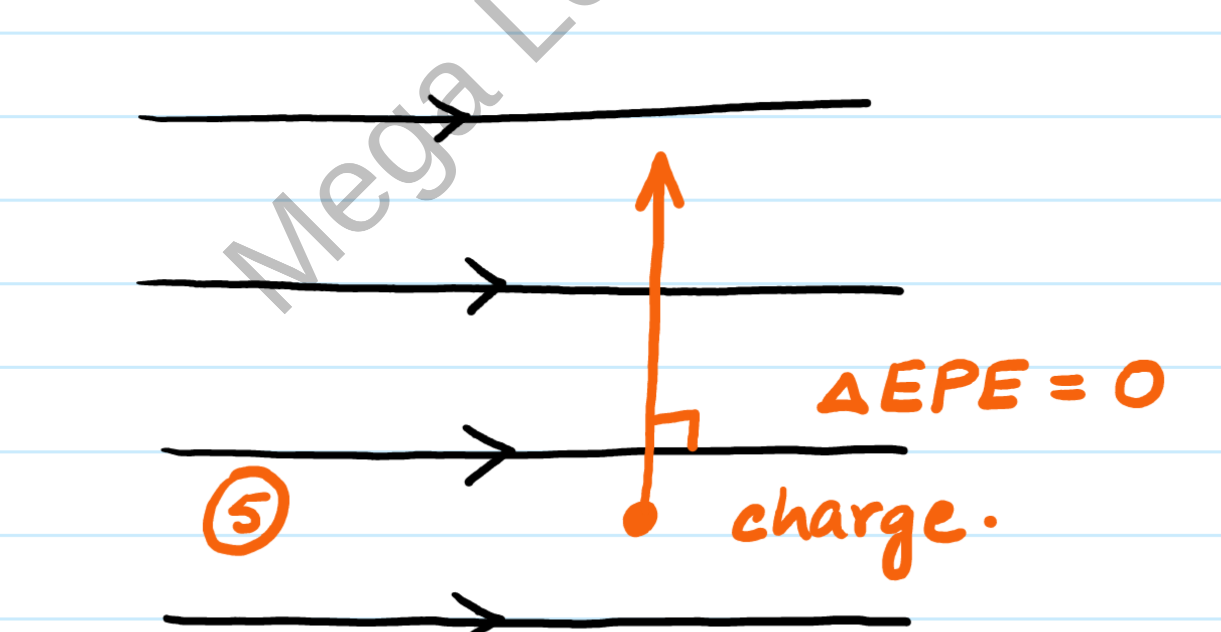
① If a +ve charge moves in the direction of the Electric field, its K.E ↑, EPE ↓

② If a +ve charge moves against the direction of the Electric field, its K.E ↓, EPE ↑

③ If a −ve charge moves against the field K.E ↑ EPE ↓

④ If a −ve charge moves in the direction of the field K.E ↓ EPE ↑

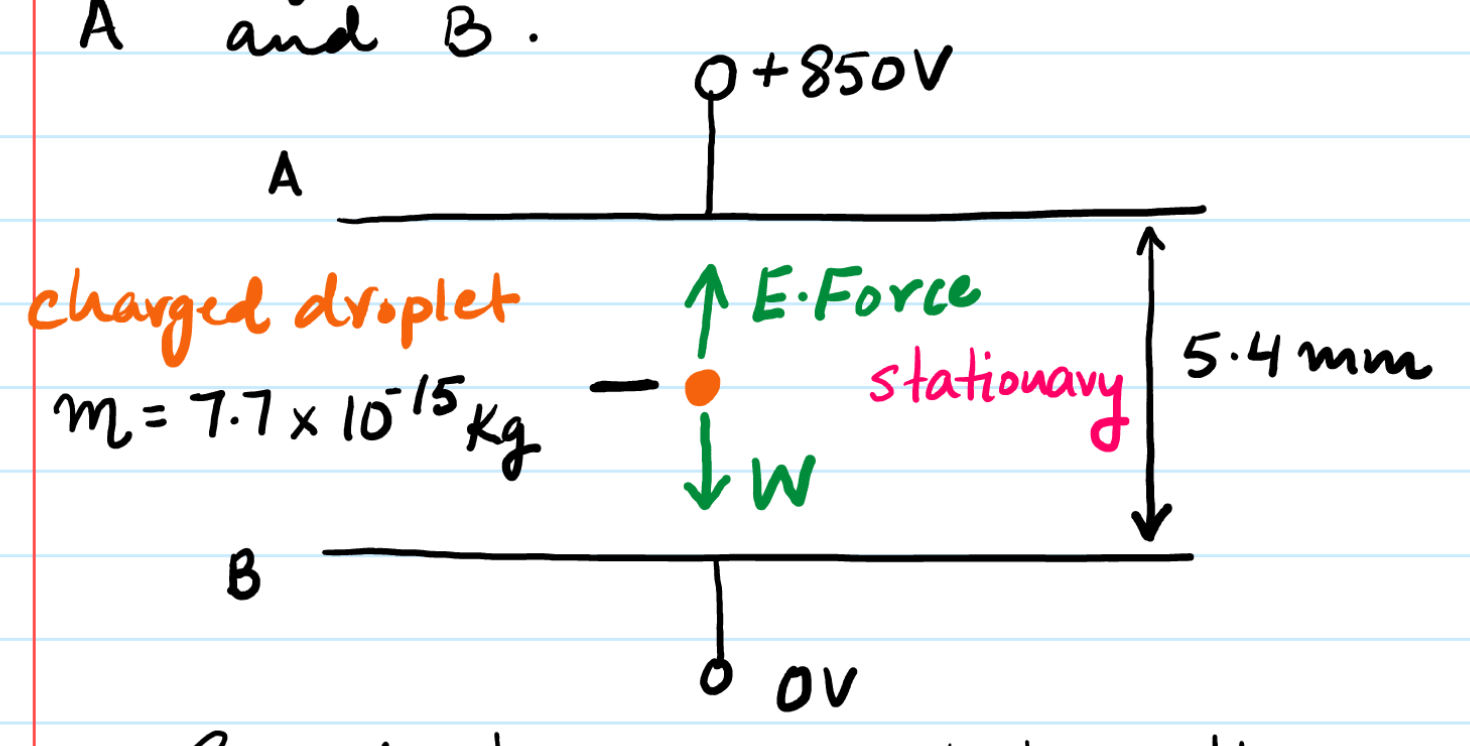
Mechanics A O → O B
Δ G.P.E = 0



⑤ If a charge is moved perpendicular to the field lines than ΔEPE / W.done = 0.

"Quantization" of charge.

Example The diagram below shows a charged particle positioned b/w two metal plates A and B.



(a) Suggest & explain whether the charged droplet is +vely charged OR −vely charged if we want it to maintain its stationary position

Ans Wt = downwards, so to remain stationary, Electrical force must act upwards hence for this to happen, the charged droplet must be negatively charged.

(b) Hence calculate the magnitude of the charge on this droplet?

$W = F_E$
$mg = E \cdot q$
$mg = \frac{V}{d} \cdot q$

$$q = \frac{m \cdot g \cdot d}{V}$$

$m = 7.7 \times 10^{-15}$ Kg
$V = 850V$
$d = 5.4$ mm

$$q = \frac{(7.7 \times 10^{-15})(9.81)(\frac{5.4}{1000})}{850}$$

$$q = 4.8 \times 10^{-19} C$$

charge of an electron $= 1.6 \times 10^{-19} C$

My suggestion is that the value of q has to be any "ONE" of the following answers

$1.6 \times 10^{-19} C$
$3.2 \times 10^{-19} C$
$4.8 \times 10^{-19} C$
$6.4 \times 10^{-19} C$
$8.0 \times 10^{-19} C$
$9.6 \times 10^{-19} C$

This idea that charges exist as integer multiples of the elementary charge is known as Quantization

Q. What is the meaning of the term "CHARGES ARE QUANTIZED"

Ans:: The term Quantization means that charges exist as integer (whole #) multiples of the elementary charge where the term elementary charge refers to the charge of an electron i.e $1.6 \times 10^{-19} C$