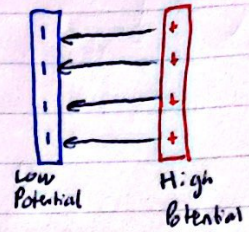
Electric Potential

- Electric Potential [redacted]
  - The amount of work needed to move a unit of electric charge a specific distance through an electric field.



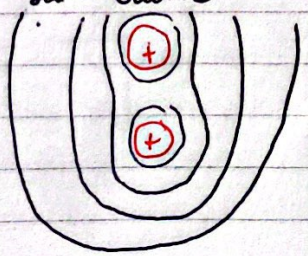
Formulae: $\Delta V = \frac{\Delta U}{q_0} = -\int \vec{E} \cdot \vec{dr}$ [redacted] Units: Volts

- not dependent on the charge in the field

- Absolute Electric Potential
  - The amount of energy-per-unit-charge that it takes to move a small, positive, test-charge from indefinitely far away to a given position.

Formula: $V = k\frac{q}{r}$

- Equipotentials
  - Lines in which every point has the same electric potential

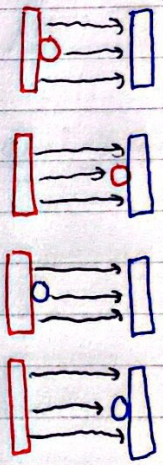


  - Able to calc electric field based on potential

Formula: $E_x = -\frac{dv}{dt}$

Electric Potential Energy

(Dependent on charge in field)



$W = qEd$

$\Delta U = -\int_i^f q\vec{E} \cdot \vec{ds}$

Question 1

How much work is done in moving a +2.6 μC charged particle from a point with a potential of 100.0 V to a point with a potential of 20 V?

$$\Delta V = \frac{\Delta U}{q}$$

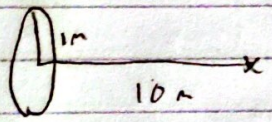
$80 = 2.6\,\mu C = \Delta U = \text{work}$

$$\text{Work} = -2.08 \times 10^{-4}\ J$$

* negative sign b/c high to low potential

Question 2

A hoop has a charge of +2.6 C, and radius of 1 m. Determine the electric potential for this hoop at a point along its axis of rotation 10 m away



$$V = \int K \frac{dq}{r} = \frac{KQ}{r}$$

$$= \frac{k(2.6)}{\sqrt{1^2 + 10^2}} = \frac{9.0 \times 10^9 \cdot 2.6}{\sqrt{101}}$$

$$= 7.36 \times 10^8\ V$$

Question 3 (7.65)

$a \leq r \leq b$

$$V = \int_b^a E \cdot dr = KQ\left(\frac{1}{a} - \frac{1}{b}\right)$$

Question 4

A potential difference of 120 V is applied between two parallel plates what is the Electric field if they are 2.5 cm apart?

$$\Delta V = -\int \vec{E} \cdot ds$$

$$\Delta V = Ed$$

$$E = \frac{V}{d} = \frac{120}{2.5\text{ cm}} = 4.80 \times 10^4\ V/m$$