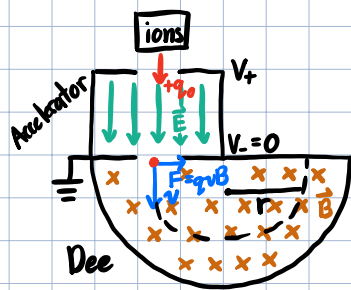# Mass Spectrometer: A device to separate isotopes
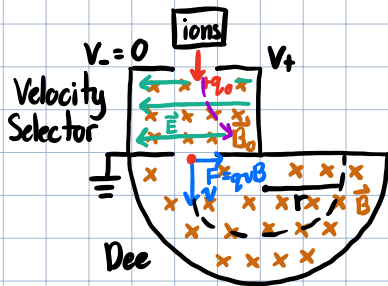
- For fast ions,

$$r = \frac{mv}{qB} \rightarrow m = \frac{rqB}{v}$$

$$K_+ + U_+ = K_- + E_- \rightarrow qV = \frac{1}{2}mv^2 \rightarrow v = \sqrt{\frac{2qV}{m}}$$

$$\rightarrow m = \frac{r^2 q B^2}{2V_+}$$, so you can find mass of an ion to see how many neutrons it has
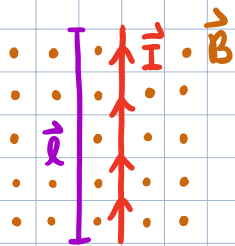
- For slow ions,

In order for q_0 to go through, $F_E = F_B \rightarrow qE = qvB_0$
$\rightarrow v = \frac{E}{B_0}$
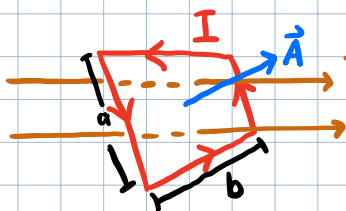
$$m = \frac{rq B_0 B}{E}$$

Magnetic Force and Currents

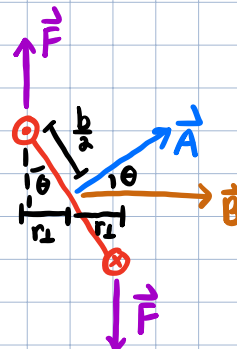- Consider a wire carrying a current:

$$\vec{F}_B = q\vec{v} \times \vec{B} = q\frac{\vec{\ell}}{t} \times \vec{B} = I\vec{\ell} \times \vec{B}$$

- Torque on a current loop in $\vec{B}$:

$\rightarrow$ Cross-Section:

$$\sum \tau = IAB\sin(\theta), \quad \tau \text{ causes } \vec{A} \text{ to line up with } \vec{B}$$