EX 3.46

- How can one obtain $\frac{e}{m}$ from directly measured quantities? Such as: the total charge collected in a beam stop (Q), the accelerating voltage (ΔV) and the temperature rise of the beam stop (ΔT).
- When you shoot a beam of electrons at a beam stop, the beam stop heats up & collects charge.
- The temperature rise ΔT is given by

$$C\Delta T = N \tfrac{1}{2} m v^2$$

($C\Delta T$: heat deposited in stop; N: # of electrons; $\frac{1}{2}mv^2$: KE of 1 electron)

- The total charge Q accumulated in the beam stop is given by $Q = Ne$
- Combining these two equations gives $\boxed{\frac{e}{m} = \frac{v^2}{2}\frac{Q}{C\Delta T}}$
- Now we can eliminate v^2 by using the fact that an electron beam is deflected by angle θ when traveling a length l at speed v through a magnetic field B:

$$\boxed{\theta \approx \frac{elB}{mv}}$$

- Combining these two equations gives $\boxed{\frac{e}{m} = \frac{2C\Delta T\theta^2}{l^2 B^2 Q}}$