Physics 209, Lecture 9

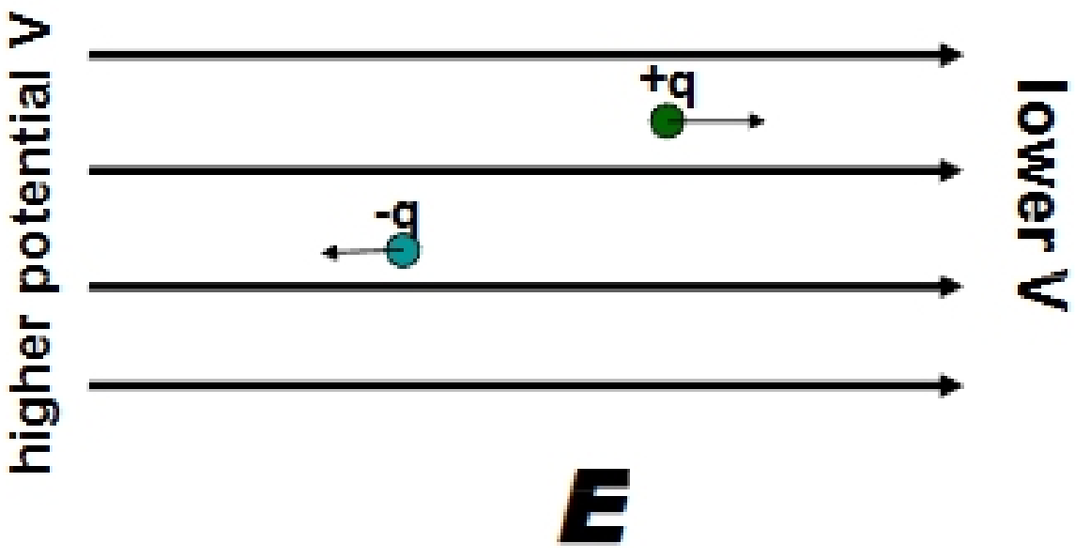
Today's Topics

- Current And Resistance (Ch. 27)
  - Motion of Charged Particle In Electric Field (review)
  - Current: Macroscopic and Microscopic Views
  - Resistance: Macroscopic and Microscopic Views
  - Electrical Power
- Expected from Preview:

  Current, current density, drift velocity, Ohm, Ampere, power, …

Motion Of Charged Particle In The Electric Field

- Fundamental Formulas:
  - $F=qE$
  - $a=F/m = qE/m$
  - $v= v_i +at$ → if $v_i =0$, then $v= at$
- A Picture to remember



If initially at rest

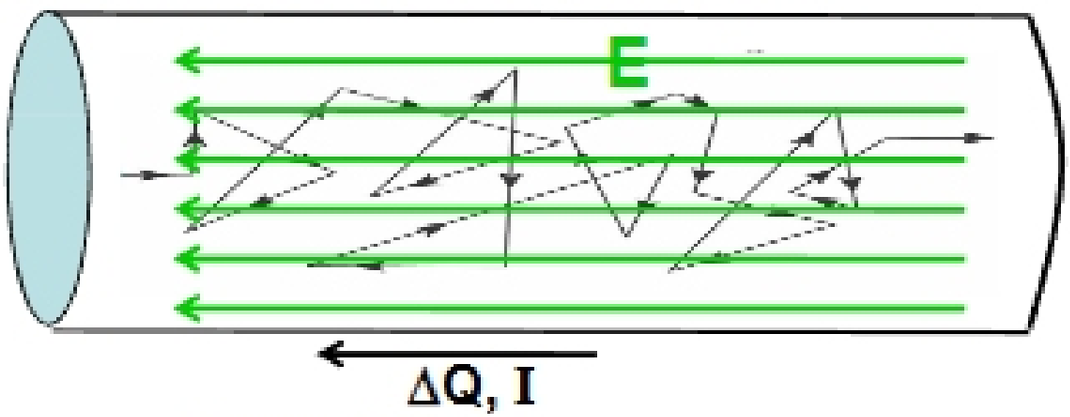
Motion of +q:
Same dir. as *E*
From high V to low V

Motion of - q:
Opposite dir. as *E*
From low V to high V

Charge Motion in a Conductor

- Without electric field:
  - electrons move randomly (thermal motion) $|v_{av}|=0$, $|v|_{av} > 0$

- With electric field applied:
  - electron motion = thermal + drift (directional): $|v_{av}| = v_{drift} > 0$, $|v|_{av} > 0$
  - i.e. a net charge ΔQ is moving directionally



- Average current: $I = \frac{\Delta Q}{\Delta t}$
- Instantaneous current : $i = \frac{dQ}{dt}$

"direct current (DC)"
I = constant