March 1, 2017 Physics 132 Prof. E. F. Redish

- **Theme Music:** Oasis
  She's Electric
- **Cartoon:** Bob Thaves
  Frank & Ernest

3/1/17 Physics 132 **1**

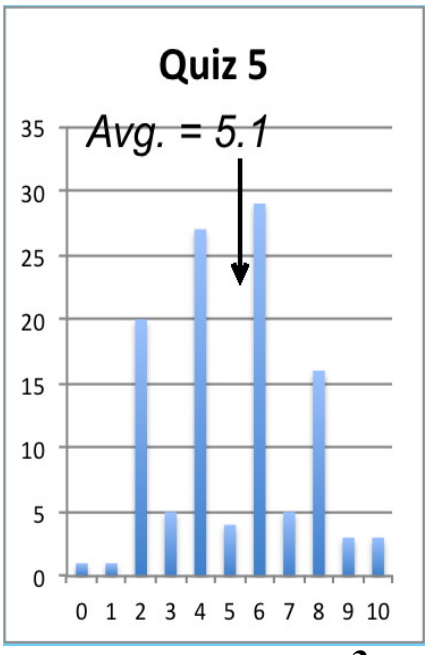
Outline

- Go over Quiz 5
- Field of two large parallel plates
- Capacitance
- The field and potential in a capacitor

3/1/17 Physics 132 **2**

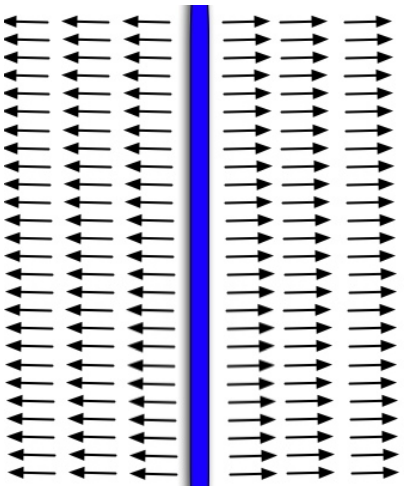
Quiz 5

	1	2	3		4
A	44%	10%	2%	PL	62%
B	14%	19%	72%	LP	38%
C	8%	51%	0%		
D	34%	19%	26%		
E		1%			

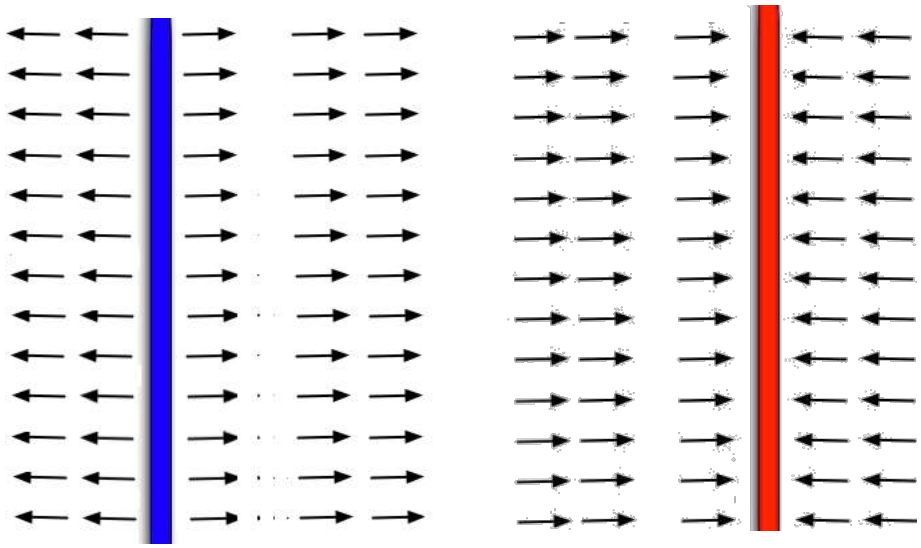


The sheet of charge

- Field is constant, pointing away from positive sheet.
- What do the equipotential surfaces look like?



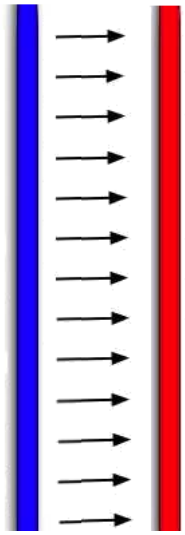
Two sheets of charge



Result

The fields of the two plates cancel each other on the outside.

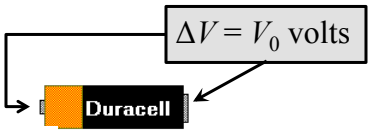
The fields of the two plates add on the inside, producing double the field of a single plate.



The fields of the two plates cancel each other on the outside.

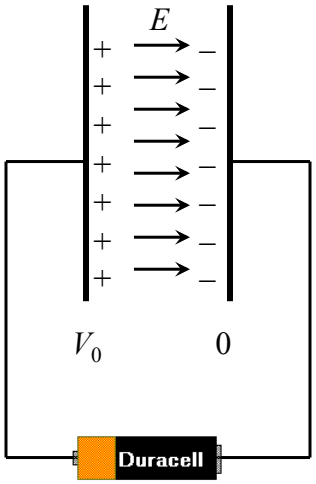
Some basic electrical ideas

- ***Conductor*** – a material that permits some of its charges to move freely within it.
- ***Insulator*** – a material that permits some of its charges to move a little, but not freely.
- ***Battery*** – a device that creates and maintains a constant potential difference across its terminals.



Charging a capacitor

- What is the potential difference between the plates?
- What is the field around the plates?
- How much charge is on each plate?



Capacitor Equations

$$\Delta V = E\Delta x = Ed$$

$$E = 4\pi k_C \sigma = 4\pi k_C \frac{Q}{A} \quad \Rightarrow \quad Q = \left(\frac{A}{4\pi k_C}\right) E$$

$$Q = \left(\frac{A}{4\pi k_C d}\right) \Delta V$$

$4\pi k_c$ is often written as "$1/\varepsilon_0$"

$$Q = C\Delta V$$

What does this "Q" stand for?

Physics 132 **10**