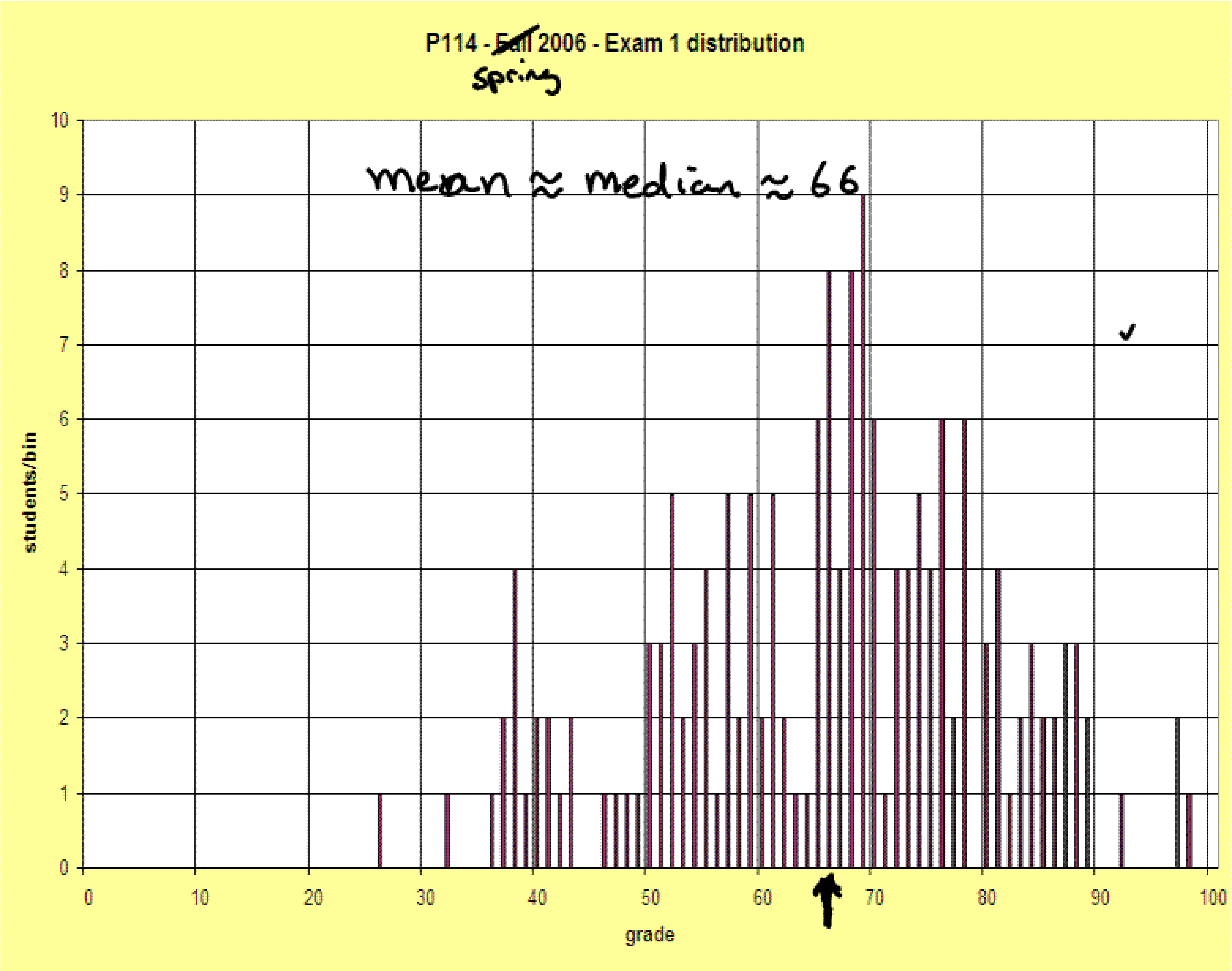
Physics 114 – February 28, 2006

Exams Graded – Solns + Distribution } on web

Problem Sets + how NOT to do them

Last Thurs. Video → PRS Survey

Video quality


P114 - Fall 2006 - Exam 1 distribution
spring
mean ≈ median ≈ 66
students/bin
grade
0
1
2
3
4
5
6
7
8
9
10
0
10
20
30
40
50
60
70
80
90
100

Last Time:

Energy to charge a capacitor to Potential V

$$U = \frac{1}{2} C V^2$$

Energy "stored" in the electric field

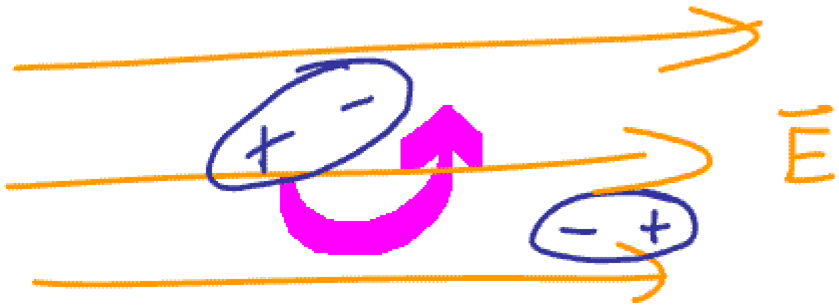
Energy density of electric field

$$\equiv u = \frac{\epsilon_0}{2} E^2$$

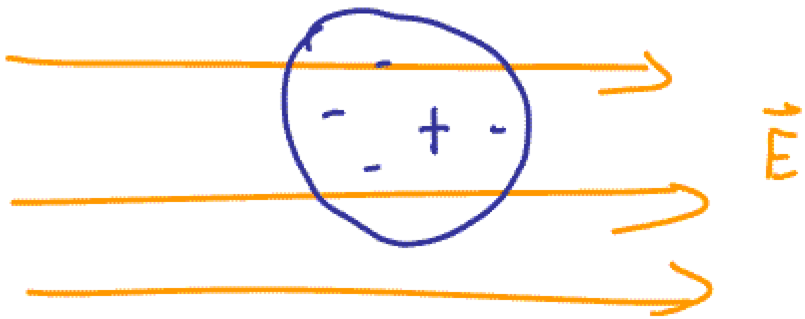
Always True!

Very important - Energy from sun comes in form of Electric and magnetic fields that make up light

Electric fields in Materials

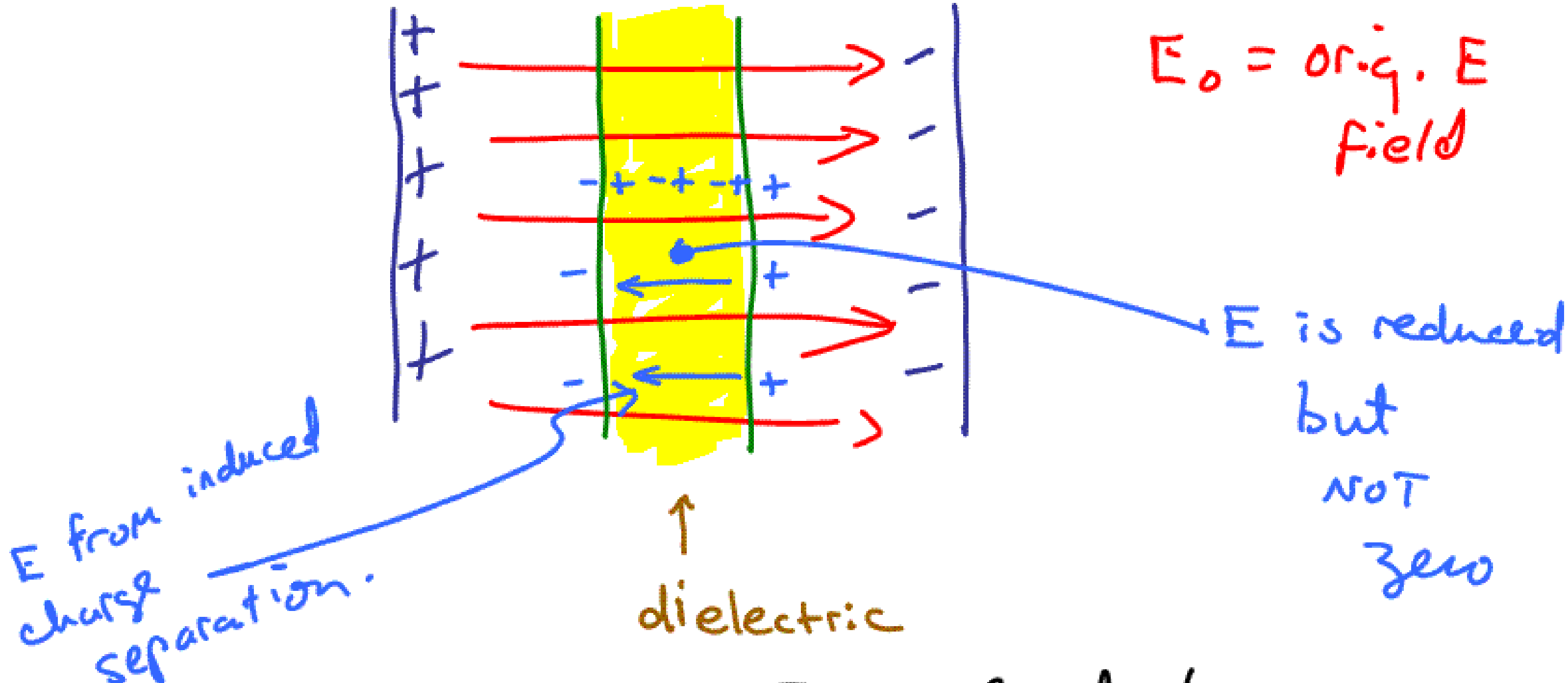


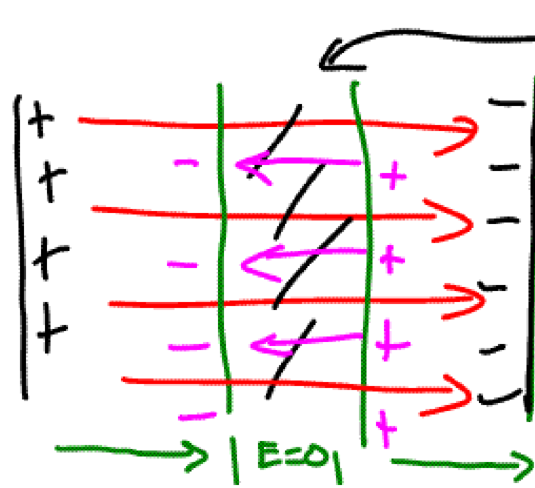
molecules w/ inherent dipoles



nonpolar ATOMS or Molecules

Either way the $\vec{E}$ inside the material is reduced





in a conductor the charge continues to separate until the induced charges creat a field that cancels external electric field

$$E_{\text{inside material}} = \frac{E_0}{\kappa}$$

κ = dielectric constant

Material dependent

$\kappa > 1$

vacuum	$\kappa = 1$
water	$\kappa = 80.4$
Air	$\kappa = 1.00054$
oil	$\kappa = 4.5$

original $E = \sigma / \epsilon_0$

dielectric

$$E_{\text{dielect}} = \frac{\sigma}{\kappa \epsilon_0}$$

$V \longrightarrow \frac{V}{\kappa}$ $\quad Q = CV$

$$C \longrightarrow C\kappa = \frac{\epsilon_0 A \kappa}{d}$$

instead of κ often see $\epsilon_0 \longrightarrow \epsilon$

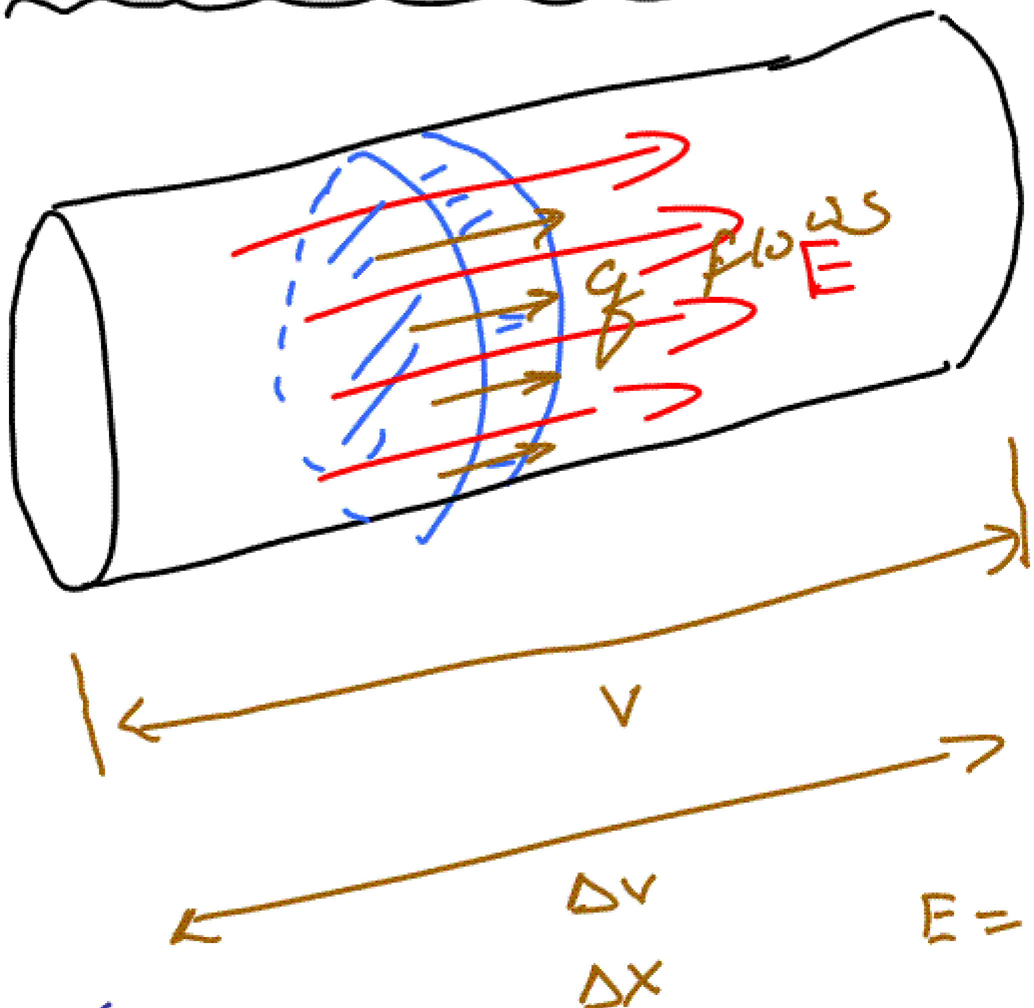
ϵ_0: Permittivity of free space

ϵ: Permittivity

$$\kappa \epsilon_0 = \epsilon$$

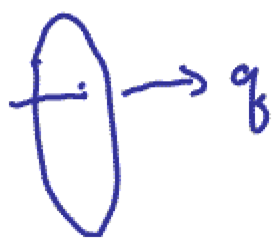
How dielectric constant is related to permittivity

Current and Resistance



$$E = -\frac{\Delta V}{\Delta X}$$

$$\frac{dq}{dt} = \text{current}$$

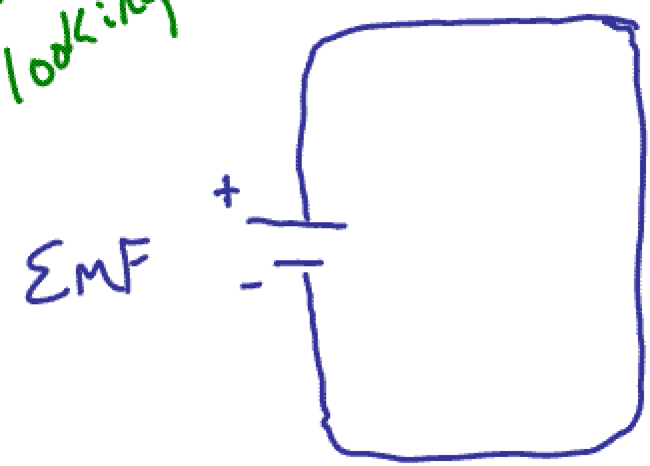


count dq in dt

$$\text{Current} = \frac{\text{Charge}}{\text{Time}} = \frac{\text{Coul.}}{s} = \text{Ampere}$$

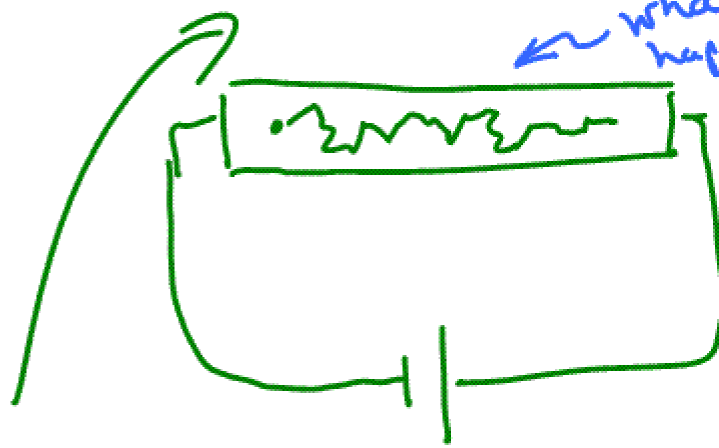
+current ≡ +i → is Always in the direction of ⊕ charge flow

Think of electrons looking for love

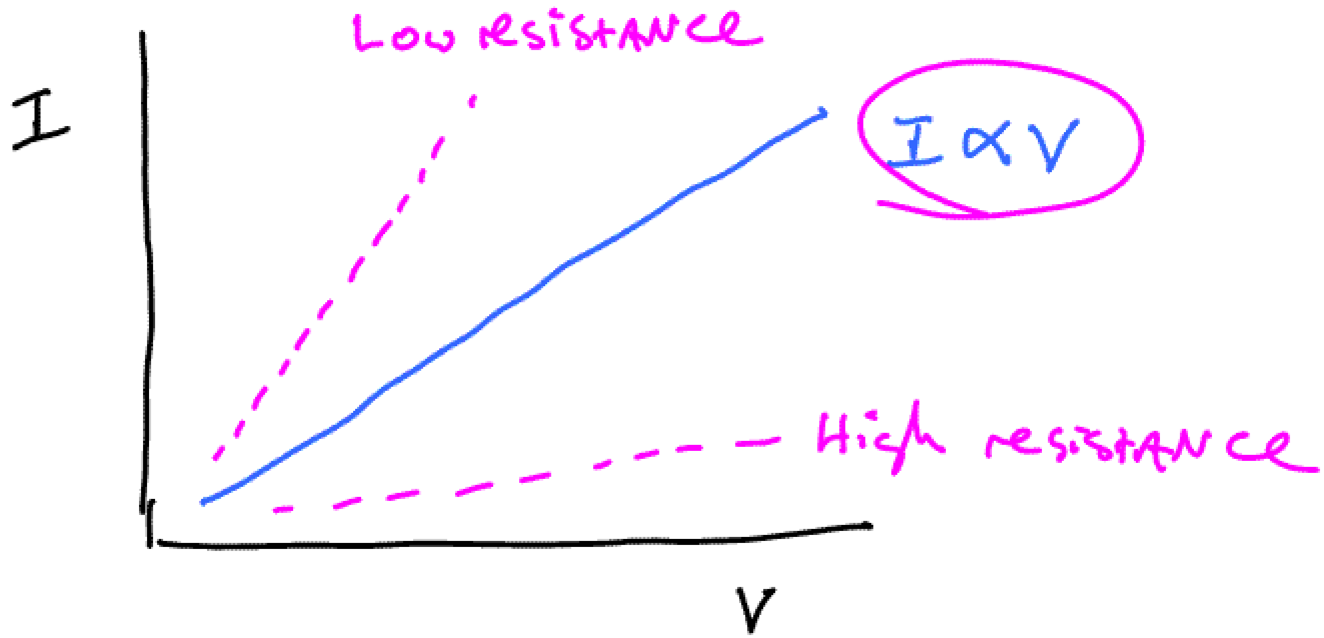


lots of little collisions

what's happening in wire

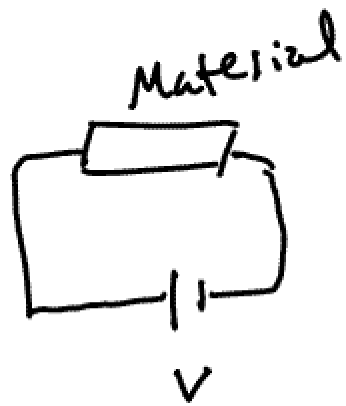


Resistance



Ohm's Law

$V = IR$



what is I

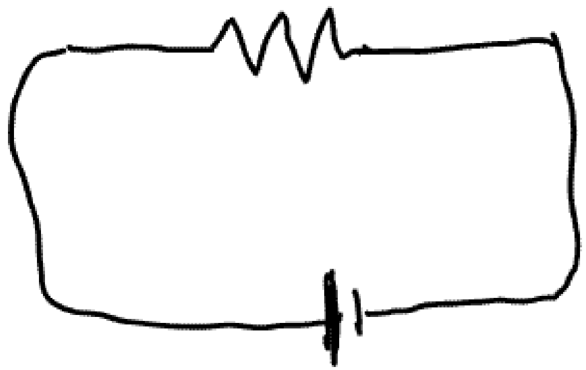
I big → low resistance

I small → high resistance

Resistance

const. of prop. bet V, I

R ≡ Resistor



R measured in ohms ≡ Ω

$V = IR$

$1 \text{ ohm} = \frac{1 \text{ volt}}{\text{Ampere}}$

$V = iR$

$V = \frac{W}{q}$ to show the charge thru resistor

potential drop across the resistor

$W = qV$

$\frac{dW}{dt} = \frac{dq}{dt} V$ → i thru resistor

$\frac{\text{work}}{\text{time}}$ ≡ Power = $\frac{\text{Joules}}{s}$

Power spent in resistor → heat

$i = \frac{v}{R}$

$v = iR$

lacks R

$P = iv$

$\equiv$

$P = i^2 R$

lacks v

$\equiv$

$P = \frac{v^2}{R}$

lacks i

use the one that works