Howard
Steven

parallel-plate capacitor

$C = \varepsilon_0 \frac{A}{d}$

A↑ C↑ A↓ C↓
d↑ C↓ d↓ C↑

Capacitors

Equation: $C = \frac{Q}{V}$

Q – stored charge (C)
V – voltage (V)
C – capacitance (F)

Def. stores electric charge to release later

uses
flash bulb
back-up electricity
RAM
prevent DC

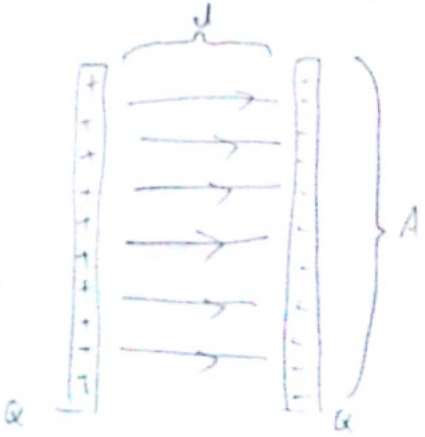
Energy

$E = \frac{1}{2}QV = \frac{1}{2}CV^2 = \frac{1}{2}\frac{Q^2}{C}$

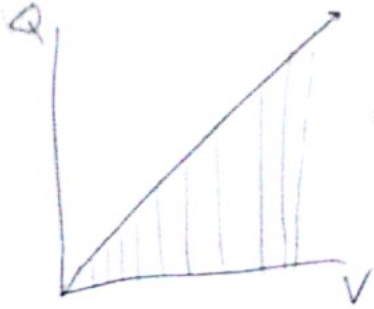
$V = Ed$

$= \frac{Q}{\varepsilon_0 \frac{A}{d}} = \frac{Qd}{\varepsilon A}$

$\varepsilon_0 = 8.85 \times 10^{-12}$ C²/N·m²



$C = \varepsilon_0 \frac{A}{d}$



Energy represented by Area

$A = \frac{1}{2}bh = \frac{1}{2}QV = \frac{1}{2}CV^2$

III. ELECTRICITY AND MAGNETISM
B. Conductors, capacitors, dielectrics
2. Capacitors
a) Students should understand the definition and function of capacitance, so they can:
(1) Relate stored charge and voltage for a capacitor.

capacitor - stores electric charge to release later

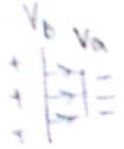
↙ two conducting objects (generally metal plates) separated

$Q = CV$

↓ stored charge (C)

↗ capacitance (F)

↓ voltage (V)



$V_b > V_a$ because, well, you know.

$Q \propto V$
$Q \propto C$
$C \propto \frac{1}{V}$

III. ELECTRICITY AND MAGNETISM
B. Conductors, capacitors, dielectrics
2. Capacitors
a) Students should understand the definition and function of capacitance, so they can:
(2) Relate voltage, charge and stored energy for a capacitor.

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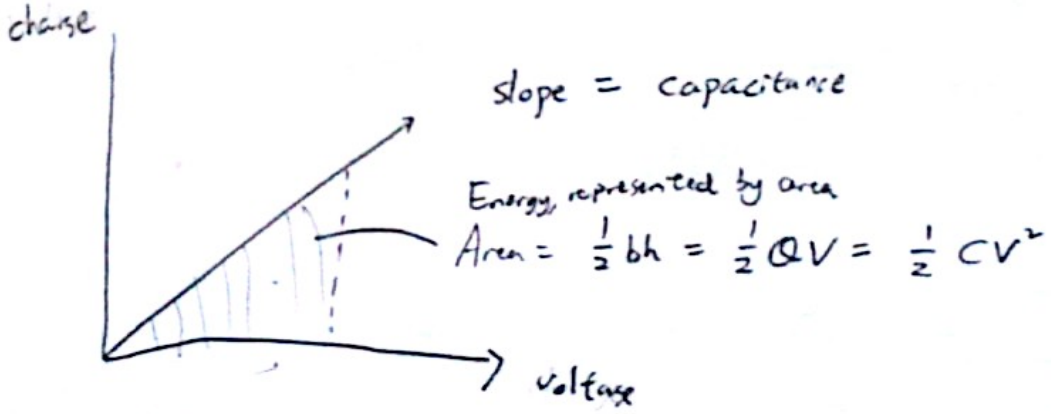
Definition of capacitance: charge per voltage.

$$C = \frac{Q}{V} \quad \text{(measured in F)} \qquad Q = CV$$

Definition of voltage: energy per charge

Energy is the area under the Q vs. V graph.

If Q is constant, Energy = QV



Ch. 17
Section 7

III. ELECTRICITY AND MAGNETISM
B. Conductors, capacitors, dielectrics
2. Capacitors
a) Students should understand the definition and function of capacitance, so they can:
(3) Recognize situations in which energy stored in a capacitor is converted to other forms.

A capacitor stores elatric charge.

Parallel Plate capacitors

↓

Energy stored within a capacitor

$PE = \frac{1}{2}QV = \frac{1}{2}CV^2 = \frac{1}{2}\frac{Q^2}{C}$

light - flash of a camera
backup electricity
to prevent DC current

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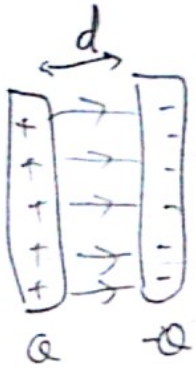
III. ELECTRICITY AND MAGNETISM
B. Conductors, capacitors, dielectrics
2. Capacitors

b) Students should understand the physics of the parallel-plate capacitor, so they can:
(1) Describe the electric field inside the capacitor, and relate the strength of this field to the potential difference between the plates and the plate separation.



$$C = \frac{Q}{V}$$

$$V = \frac{Q}{C}$$

$$V = Ed$$

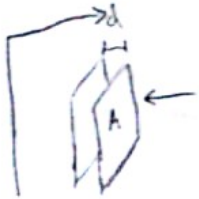
$$V = \frac{Q}{\varepsilon_0 \frac{A}{d}} = \frac{Qd}{\varepsilon_0 A}$$

$$C = \varepsilon_0 \frac{A}{d}$$

III. ELECTRICITY AND MAGNETISM
B. Conductors, capacitors, dielectrics
2. Capacitors
b) Students should understand the physics of the parallel-plate capacitor, so they can:
(4) Determine how changes in dimension will affect the value of the capacitance.

$$C = \varepsilon_0 \frac{A}{d}$$

capacitors are used to store charges by using two parallel plates of opposite charge.



← More surface area means more electrons cross

higher distance means electrical force is diminished