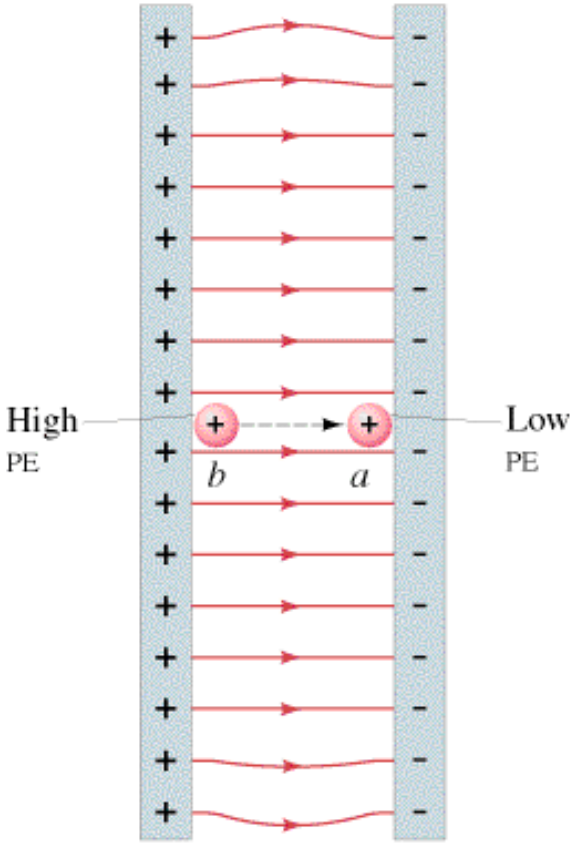
# Ch 17. Electric Potential

# I. Electric Potential




Electric potential (Scalar):

potential energy per charge

$V_a = PE_a/q$

volt: 1volt (V) =1J/C

Potential difference: voltage

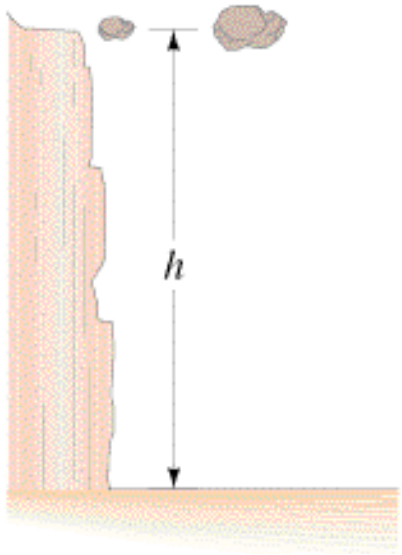
$V_{ab} = V_a - V_b$

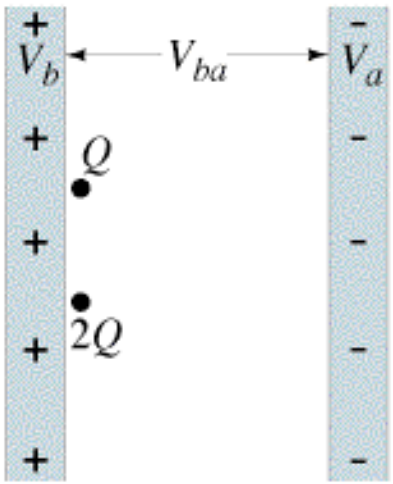
0 potential: gound or infinity

# Potential Energy

$\Delta PE = PE_b - PE_a = qV_{ba}$

Analogy with gravitational potential energy

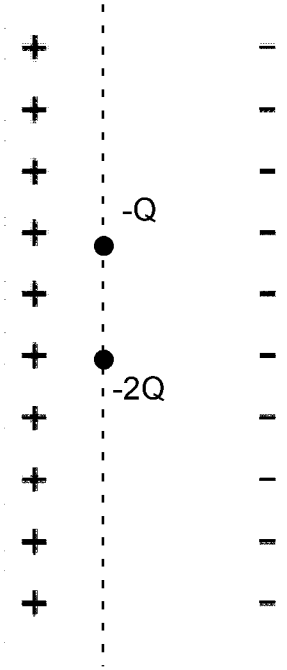



q --- mg
V --- h

Q vs. 2Q:
Same potential
Different PE

# Potential vs. Potential Energy




Potential: V; decreases along field line

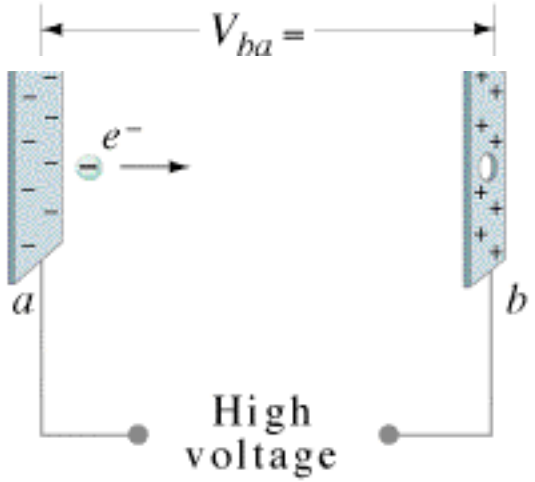
PE: qV;

At dotted line:

all charges have the same V

different PE, depending on q

# Electron Volt: Energy Unit



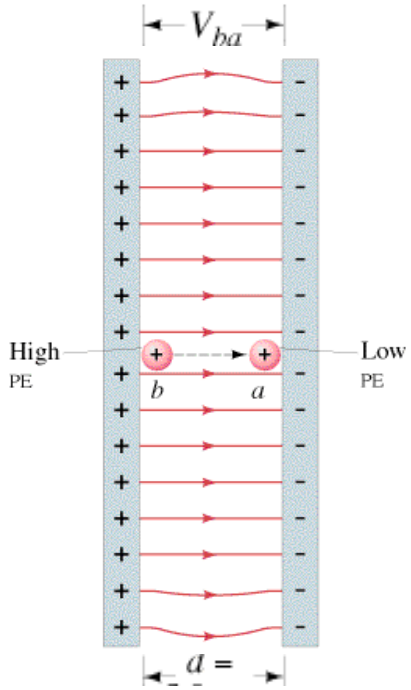

1eV= 1.6x10$^{-19}$ C x 1V

= 1.6x10$^{-19}$ J

At *a*, relative to *b*, electron has lower potential
higher PE

# Electric Potential & Electric Field

## Uniform Field




Work done=Potential Energy Change
$=qV_{ba}$

Work done by the electric force
$=Fd=qEd$

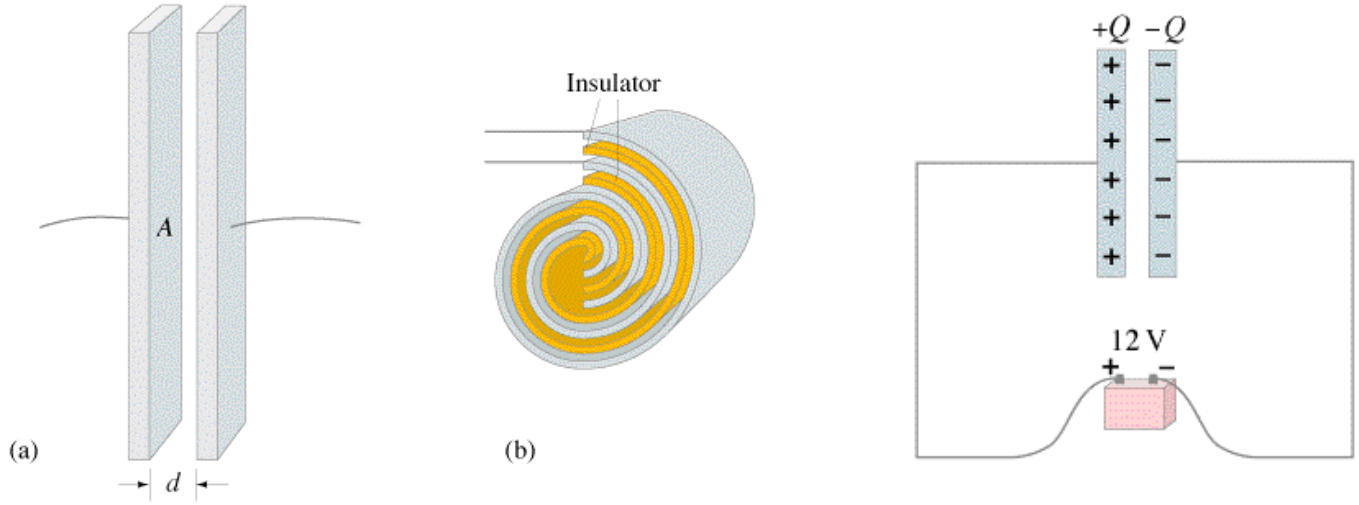
So $qV_{ba} = qEd$

$V_{ba} = Ed$

$E = V_{ba}/d$

Unit for E: 1N/C=1V/m

# II. Capacitance




Capacitor: a charge storing device

Two non-touching conducting objects, each carry Q

Capacitance C= Q/V, 1 farad (F) =1C/V

Fixed for a given capacitor

Q relates to V through C, Q=CV

Stores electric energy

# Summary for Electrostatics

$$F = k\frac{Q_1 Q_2}{r^2}$$

$$\boldsymbol{F} = q\boldsymbol{E}$$

$$E = k\frac{Q}{r^2}$$

$$V_{ba} = Ed \text{ (uniform field)}$$

$$V = PE/q$$

$$Q = CV$$