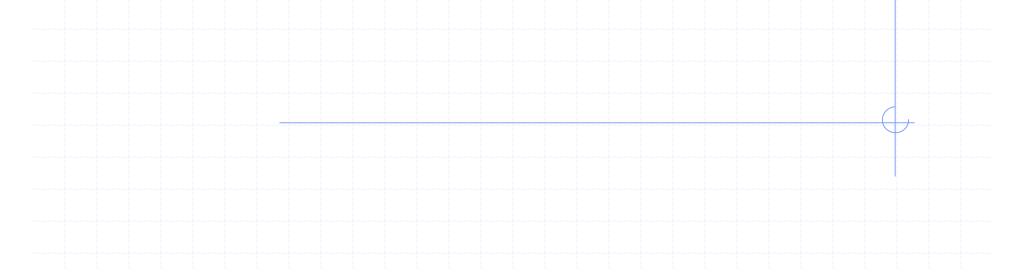
Chapter 19 Summary Bare-bones Style

i.e. stuff you need down COLD



Electric Potential Energy

Analogous to $W_{AB} = mgh_A - mgh_B$ gravitational potential energy $W_{AB} = GPE_A - GPE_B$ As charge moves from A to B, work is done in same way $W_{AB} = EPE_A - EPE_B$ work is done in gravitational field

Electric Potential Difference

 It is useful to express the work per-unit-charge as "voltage"
Analogous to heat vs. temperature.
Units are "volts"
q_o=test charge

 $W_{AB} = EPE_A - EPE_B$ $\underline{W_{AB}} _ \underline{EPE}_A \quad EPE_B$ $q_0 \qquad q_0$ q_0 _ *EPE* q_0

Electric Potential and Work

The voltage difference between two points is the opposite of the work done per charge, moving the test charge by the from A to B

 q_0

 $VV = \frac{VEPE}{M} = \frac{-W_{AB}}{M}$

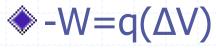
 q_0

Work done on a charge in an electric field

 Moving a charge in an electric field from a higher to a lower potential , ΔV is negative and the work done on the charge is positive (i.e., the charge speeds up)

• $-W = q(-\Delta V)$ or simply W = qV

Likewise, moving a charge in an electric field from a lower to a higher potential, the work done is negative (i.e., the charge slows down)



Electric Potential Difference Created by Point Charges

 $=\frac{kqq_0}{r}-\frac{kqq_0}{r_B}$ We assume point charge and test $W_{AB} =$ charge are calculus, find work $VV = \frac{-W_{AB}}{-W_{AB}} = \frac{kq}{kq}$ positive. Using kq $\Gamma_A \Gamma_B$ q_0 done in going A-B. Then, we can find $V = \frac{kq}{V}$ the potential of V that single charge.

Capacitors

Device used to store electric charge Each plate has same amount of charge q = (V')Experiments show q and V are proportional. Constant of proportionality is C, the capacitance and has units called farads (F).

Dielectrics (parallel plate capacitor) E_{0}

- Insulating material in between capacitor plates
 Increase charge stored by decreasing electric field and "tension" in capacitor
 Described mathematically by dielectric constant
- Assuming charge is kept fixed
- eo is the permittivity of free space

 $\kappa = \frac{E_0}{F}$ $E = \frac{V}{d} = \frac{E_0}{\kappa}$ $E_0 = \frac{q}{\varepsilon_0 A}$ $q = \varepsilon_0 A E_0$ $q = (V\frac{\kappa}{d}\varepsilon_0)A$ q = CV $C = \frac{\kappa \varepsilon_0 A}{d}$

Energy of Capacitor

Because of its configuration, a capacitance can store energy.
Dielectrics increase the amount of energy stored.

$$E = \frac{1}{2}qV$$

$$E = \frac{1}{2}(CV)V = \frac{1}{2}CV^{2}$$

 $E = \frac{1}{2}q(\frac{q}{C}) = \frac{1}{2}\frac{q^2}{C}$

