EECS 16A ##10.15 LECTURE 13 ##

POWER & ENERGY

$P = dE/dt$, which implies $E = \int P(t)\,dt$

ex. 10 W light bulb for 1 h → $E = 10 \cdot 1 = 10$ Wh $= 36000$ J

UNIT $P \to W$ $E \to J \to Ws$

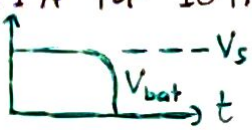
PG&E charges per kWh.

DEF Batteries store energy, measured in A·h, which isn't a real energy unit

1A → $V_c = 1.5$ V Energy $= V_c \cdot C = 1.5\,V \cdot 1\,Ah = 1.5$ Wh

1 Ah can deliver 1 A for 1 h, or 0.1 A for 10 h, etc.

Unlike a constant voltage source, a battery will eventually die →



Approx. w/ rectangle

E, P → V, I

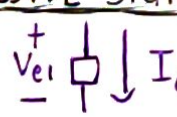
DEF $V_{ab} = dE_{ab}/dq$ the energy required to move q from a to b

DEF charge: electrons (q) Coulombs → $C = 6.2 \cdot 10^{18}$ electrons

DEF $I = dq/dt$ $1A = 1C/1s$

DEF $P = dE/dt = dE/dq \cdot dq/dt = VI$ most important of these 4 eqs

PASSIVE SIGN CONVENTION



$P_{diss} = V_{e1} \cdot I_{e1}$ $P_{diss} < 0$ is power delivery

↳ Power dissipated

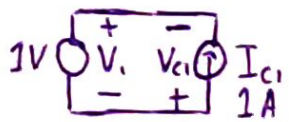
ex.

$I_R = I_{cs} = 1$ mA $V_R = R I_R = 1 \cdot 1 = 1\,A\Omega = 1$ V

$R = 1\,k\Omega$ $P_R = V_R I_R = 1V \cdot 1\,mA = 1$ mW diss.

$V_{cs} + V_R = 0 \to V_{cs} = -V_R$ $P_{cs} = -1V \cdot 1\,mA = -1$ mW deliv.

$P_R + P_{cs} = 0$ conservation of energy

ex 

$-V_1 - V_{c1} = 0$ $\quad P_{c1} = -1V \cdot 1A = -1W$

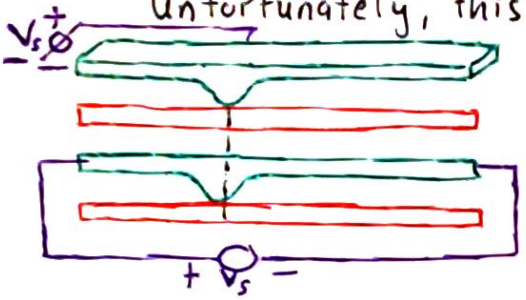
$V_{c1} = -V_1$ $\quad P_{Vs} = V_1 \cdot I_{c1} = 1W$ $\quad \Sigma = 0$

if this isn't a rechargeable V_s, 4th of July may come early

2D Touch Screen

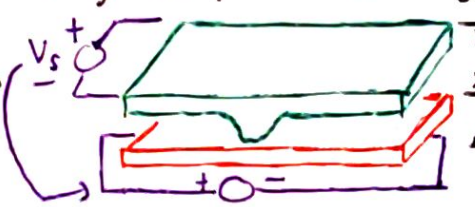
Two stacked 1D screens with an insulator in between!

Unfortunately, this isn't a very functional method.



merge the red layers & alternate $V_s \rightarrow$ down to 3 layers.

why stop at 3 layers?



one at a time

for x, connect measure

for y, connect measure