EE 220

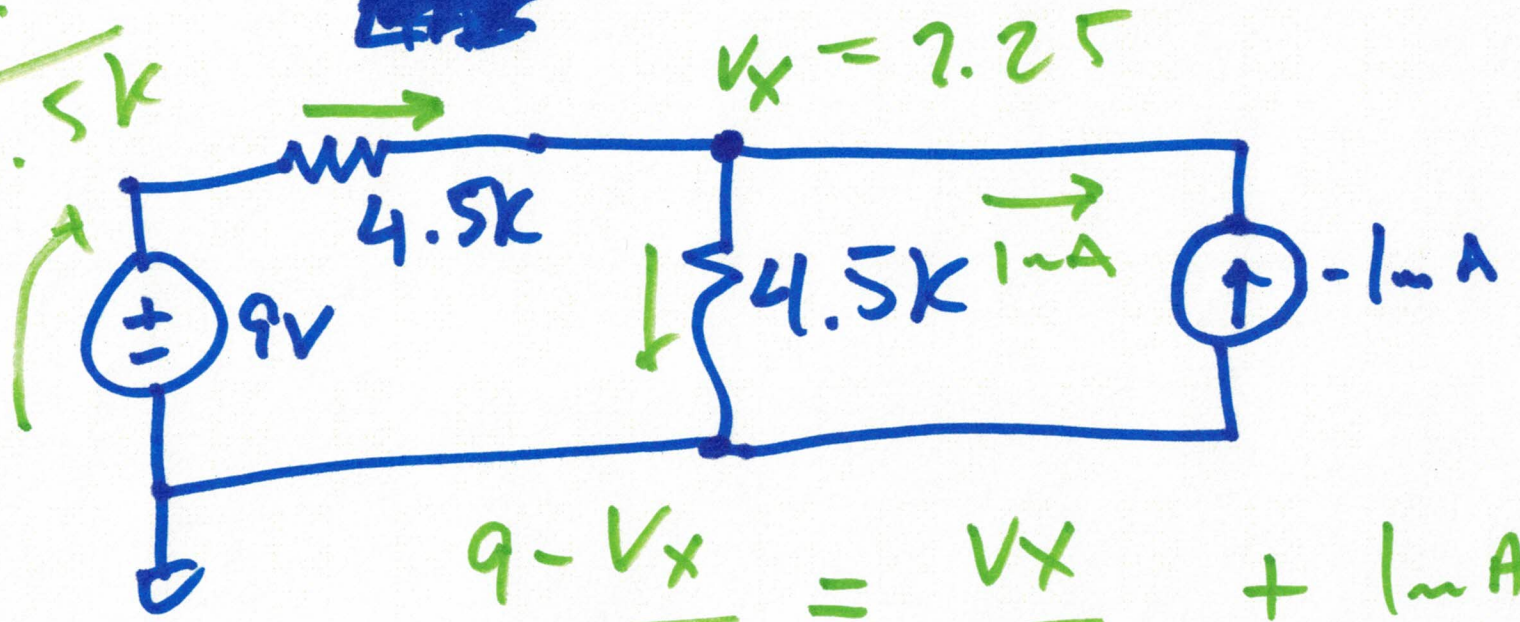
Circuits I

Lecture 14

$\frac{6.75}{4.5k} = 1.5mA$

$\frac{9-2.25}{4.5k}$

$I_s = 1.5mA$

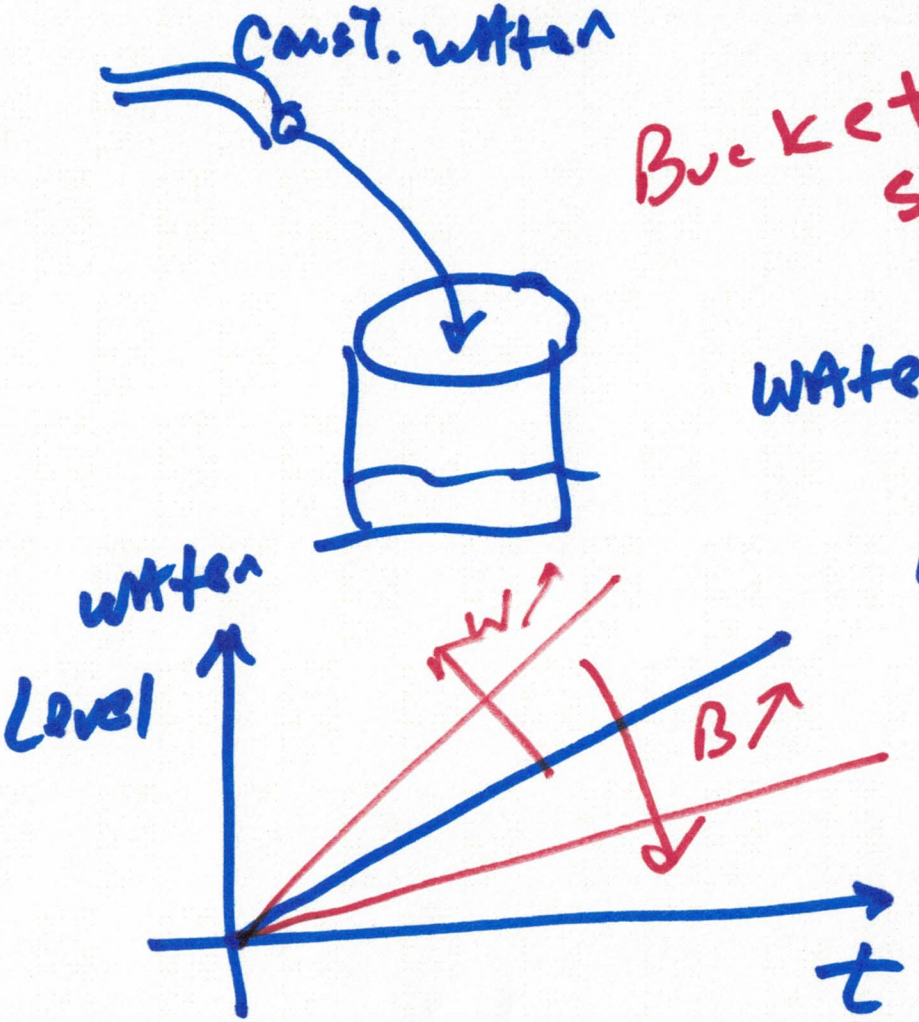


$$\frac{9-V_x}{4.5k} = \frac{V_x}{4.5k} + 1mA$$

$V_x = 2.25$

$9 - V_x = V_x + 4.5V$

$4.5 = 2V_x$



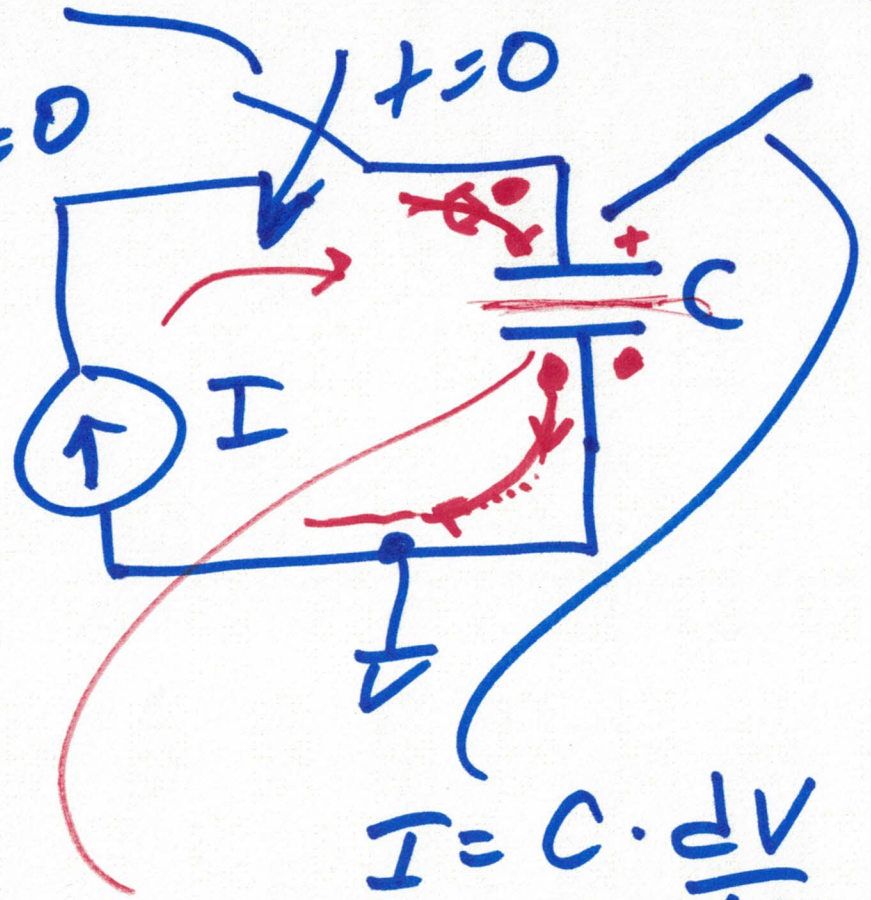
Bucket stores water

$$\text{Water} = \text{Bucket} \cdot \frac{\Delta \text{Level}}{\Delta t}$$

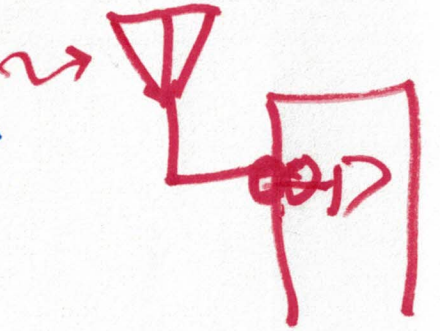
$$w = B \cdot \frac{d\,\text{Level}}{dt}$$

slope

switch closes at $t=0$



CApacitor → Farads (condenser)



$$C = \frac{Area}{t} \cdot \epsilon$$

ϵ ← dielectric

Memorize

$$I = C \cdot \frac{dV}{dt}$$

displacement current

conduction current

$$C \cdot V = Q$$

C ← Charge

Capacitance · Voltage

$I = 1mA = 0.001A = 10^{-3}A$

$C = 1{,}000\,pF = 1nF = 1{,}000 \times 10^{-12}F$

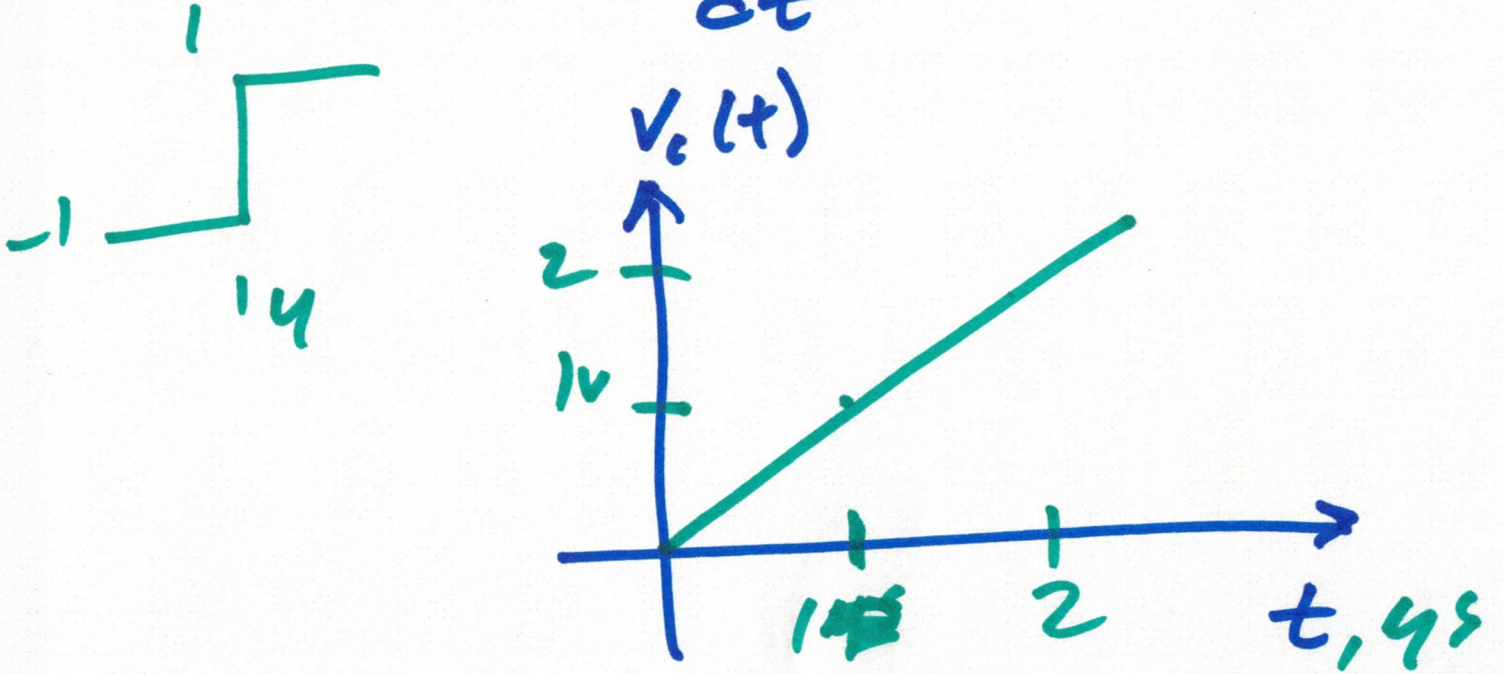
$= 1 \times 10^{-9}F = 10^{-9}F$

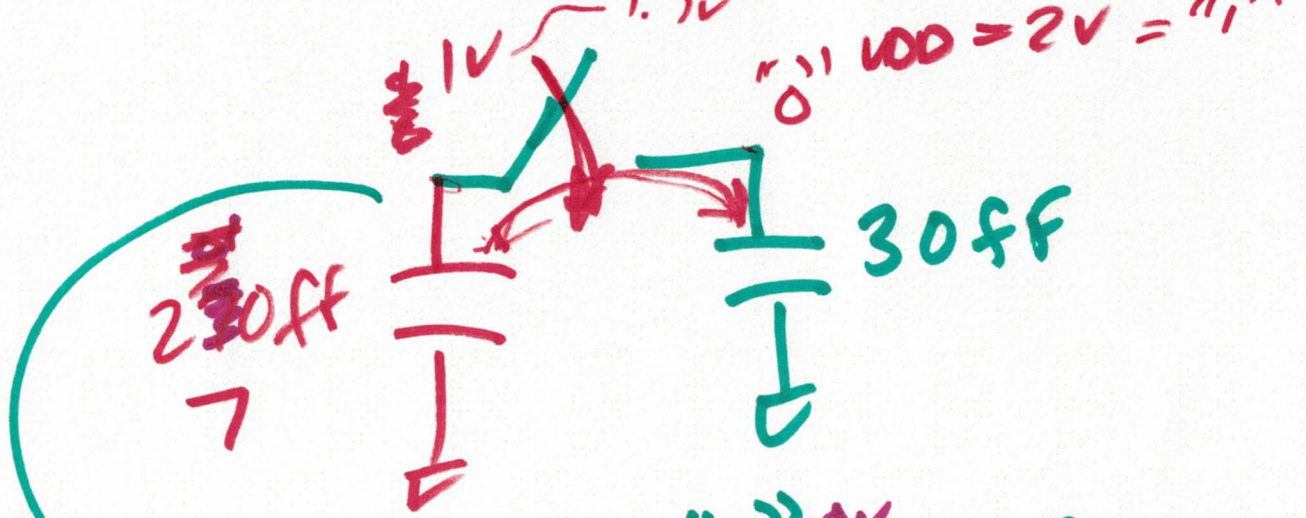
$$I = C\frac{dv_c(t)}{dt} \Rightarrow \frac{dv_c(t)}{dt} = \text{slope} = \frac{I}{C}$$

$$= \frac{10^{-3}}{10^{-9}} = 10^{6}$$

$$= \frac{1V}{10^{-6}s}$$

$$= \frac{1V}{1\mu s}$$





$Q = \frac{1}{2}$

$f = 10^{-15}$

$p = 10^{-12}$

$n = 10^{-9}$

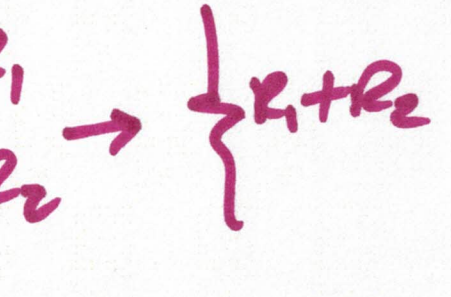
$CV = Q$

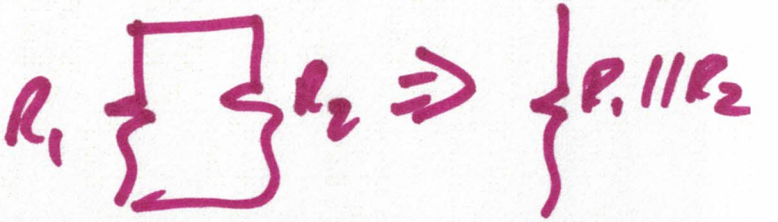
"0" 0V 0C

"1" 2V 630 fC

$$V_f(300ff) = 270\,fC + 60ff$$

$$V_f = \frac{330}{300} \approx 1.1V$$



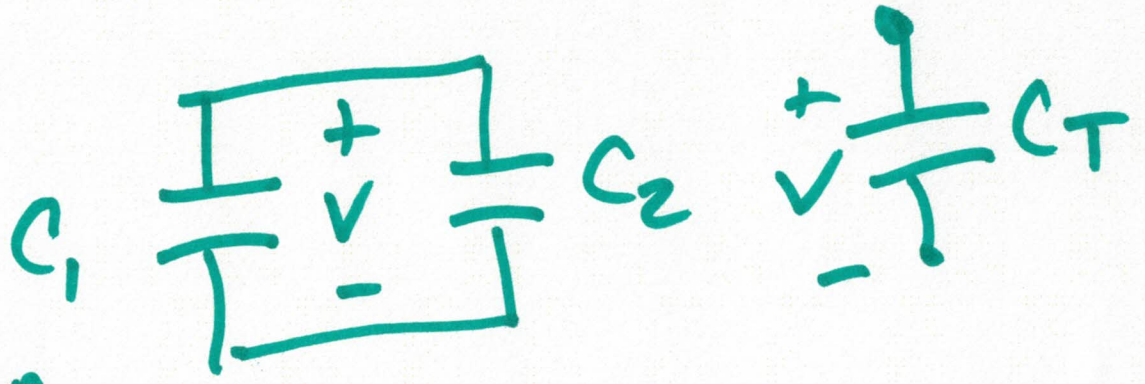


$$R_T = \frac{R_1 \cdot R_2}{R_1 + R_2} \qquad R_1 \| R_2 = R_T$$

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$$

5)

$CV = Q$



$V_T = V_1 + V_2$

$C_1 V_1 = Q$

$V_1 = \frac{Q}{C_1}$

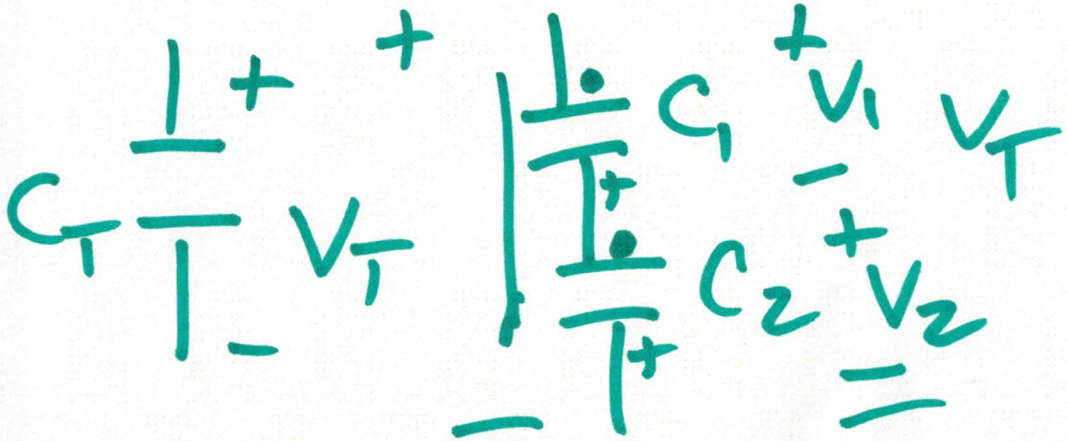
$V \cdot C_1 + V \cdot C_2 = C_T \cdot V$

$\frac{Q}{C_T} = \frac{Q}{C_1} + \frac{Q}{C_2}$

$C_T = C_1 + C_2$

$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2}$

$C_T = \frac{C_1 \cdot C_2}{C_1 + C_2}$



$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2}$

$V_2 = \frac{Q}{C_2}$

$C_T \cdot V_T = Q$

$V_T = V_1 + V_2$

$V_T = \frac{Q}{C_T}$

b)