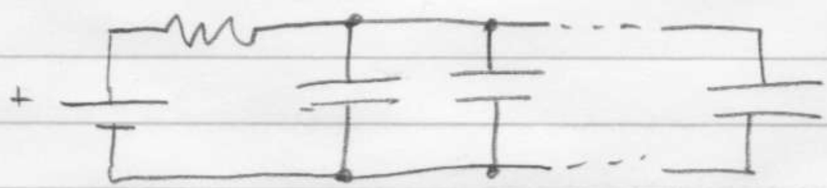
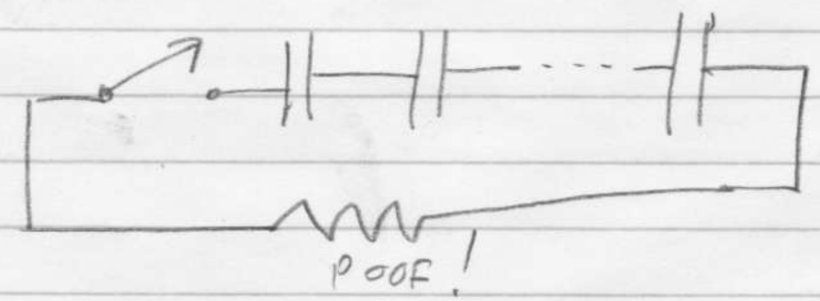
PHYS 334 WINTER QUARTER 2012
HOMEWORK 1 SOLUTIONS VER 1.0.

1. (MODIFIED EXERCISE 1.5). CAPACITORS & INDUCTORS STORE ENERGY. RAPIDLY RELEASING THAT ENERGY PROVIDES LARGE BURSTS OF POWER

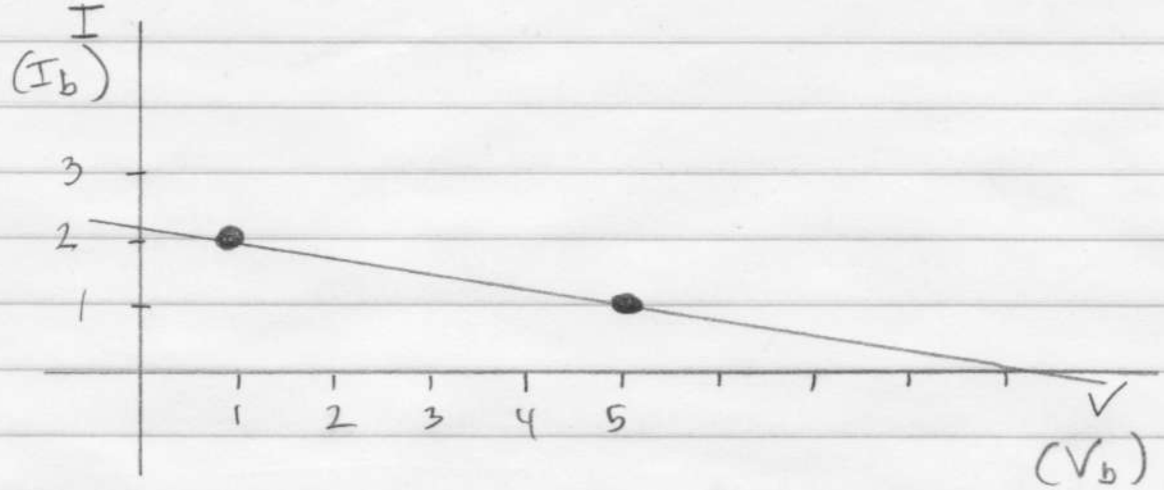
FOR EXAMPLE:
STEP 1: CHARGE PARALLEL CAPACITORS



STEP 2: REARRANGE (OR SWITCH) THOSE CHARGED CAPACITORS INTO SERIES, THEREBY FRYING THE RESISTOR.



2. (a) "OUTPUT LOADING"



(b) THE VOLTAGE INTERCEPT IS V_{TH}: $9 V_b$.
THE SHORT-CIRCUIT CURRENT IS $\approx 2.25 I_b$.
THE THÉVENIN RESISTANCE IS V_{TH}/I_{SC}

$$\approx \frac{9}{2.25} \frac{V_b}{I_b}$$

THE NORTON RESISTANCE IS THE THÉVENIN RESISTANCE

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(3) a. $V_C = 12V - 2ma \cdot 1k\Omega = 10.V$

$V_E = (2ma + 20\mu A) \times 1k\Omega \approx 2.0V.$

b. SINCE $20\mu A \ll I_d$, THE VOLTAGE AT B IS THAT OF THE UNLOADED DIVIDER-CHAIN OUTPUT, HENCE $V_B = 12V \frac{R_2}{R_1+R_2}$.

ALSO $V_B = 2V + 0.6V$, HENCE

$$(1) \quad 12V \frac{R_2}{R_1+R_2} = 2.6V$$

RECALL THAT $V_B - V_E = 0.6V$, HENCE $R_{BE} = 0$. WE CAN THEREFORE USE OHM'S LAW TO FIND THE CURRENT INTO B:

$$(2) \quad 20\mu A = \frac{12V \frac{R_2}{R_1+R_2} - 0.6V}{\frac{R_1 R_2}{R_1+R_2} + 1k\Omega}$$

WHERE $\frac{R_1 R_2}{R_1+R_2}$ IS THE THÉVENIN RESISTANCE OF THE DIVIDER CHAIN.

SOLVING FOR R_1 & R_2:

$R_1 \approx 450k\Omega$, $R_2 \approx 125k\Omega$