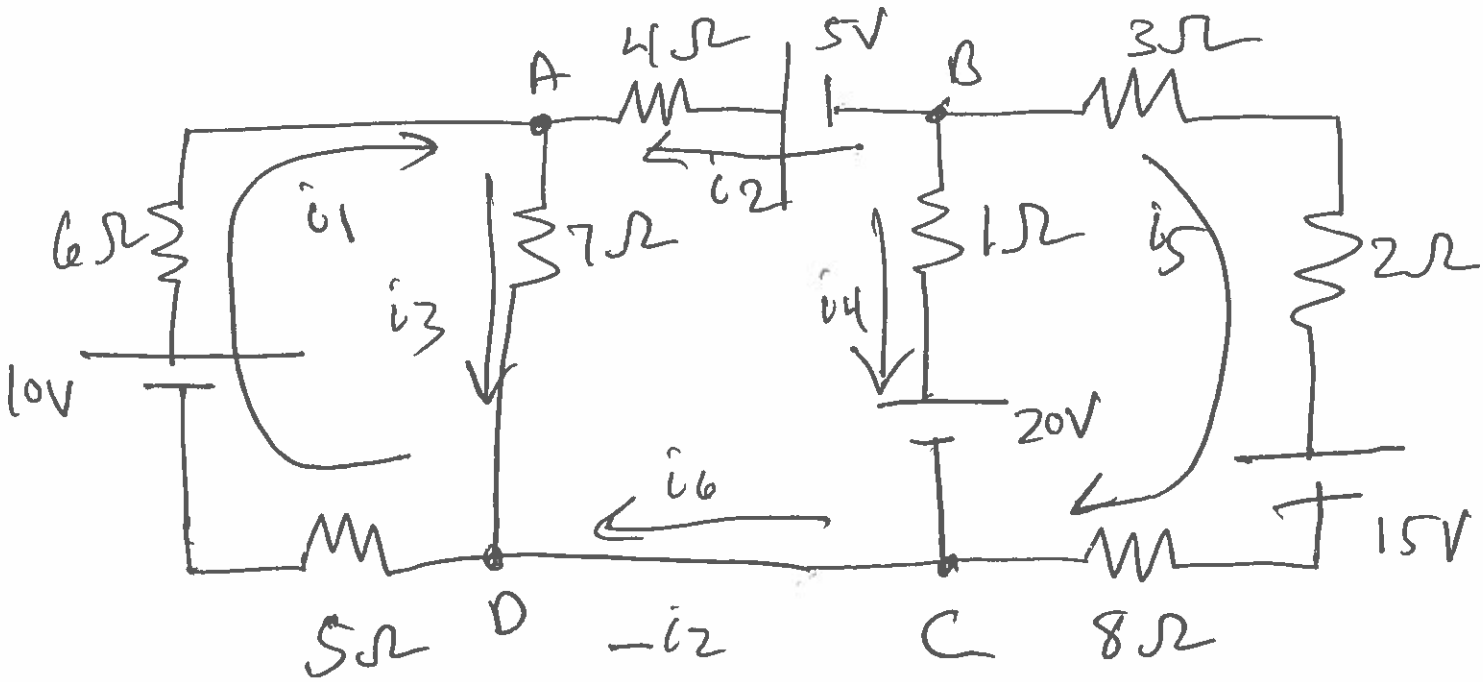


AT (A) $i_1 + i_2 = i_3$

$0 = i_2 + i_4 + i_5$

AT (B) $0 = i_2 + i_4 + i_5$

AT (C) $+i_4 + i_5 = i_6$

$i_6 = -i_2$

AT (D) $i_3 + i_6 = i_1$

Left Loop start D Clockwise

$$-i_1\,5\Omega + 10V - i_1\,6\Omega - i_3\,7\Omega = 0$$

$$+20V + i_4(1\Omega) + 5V - i_2(4\Omega) - i_3(7\Omega) = 0$$

$$+i_5(8\Omega) + 15V + i_5(2\Omega) + i_5(3\Omega) - i_4(1\Omega) - 20V = 0$$

$i_1 = -0.13211\ A$

$i_2 = +2.2543\ A$

$i_3 = 1.93732\ A$

$i_4 = -2.4504\ A$

$i_5 = 0.1961\ A$

$$\Delta V_{A\to D} = -i_3\,7\Omega = -(1.93732A)(7\Omega)$$

$$\Delta V_{A\to D} = \underline{-13.5V}$$

$$\Delta V_{A\to D} = +i_1\,6\Omega - 10V + i_1\,5\Omega$$

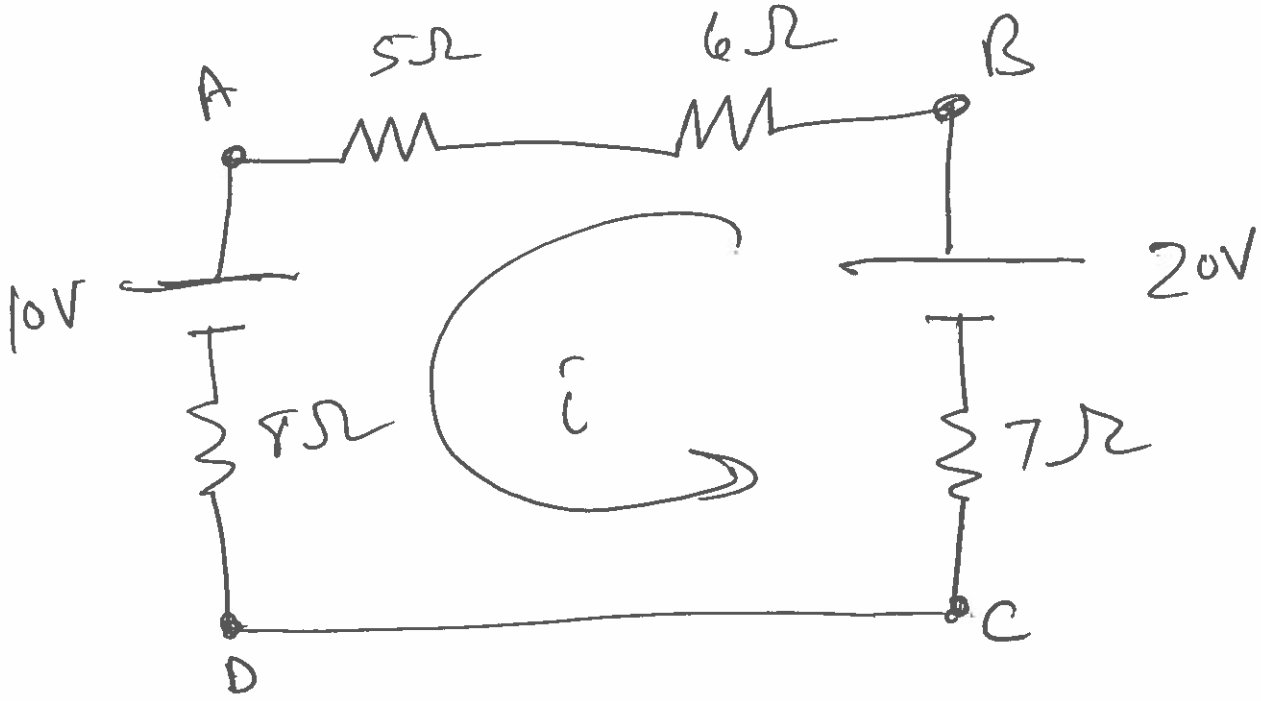
$$\Delta V_{A\to D} = +i_1(6\Omega+5\Omega) - 10V$$

$$= +(-0.13211A)(11\Omega) - 10V$$

$$= \underline{-13.5V}$$

$$\Delta V_{C\to B} = +20V + i_4(1\Omega)$$

$$= 20V + (-2.4504A)(1\Omega) = \boxed{+17.55\ V}$$



$\Delta V_{A \to B} = ? = +i(5\Omega + 6\Omega)$

$$i = \frac{V_{TOT}}{R_{TOT}} = \frac{20V - 10V}{5\Omega + 6\Omega + 7\Omega + 8\Omega} = \frac{10V}{26\Omega}$$

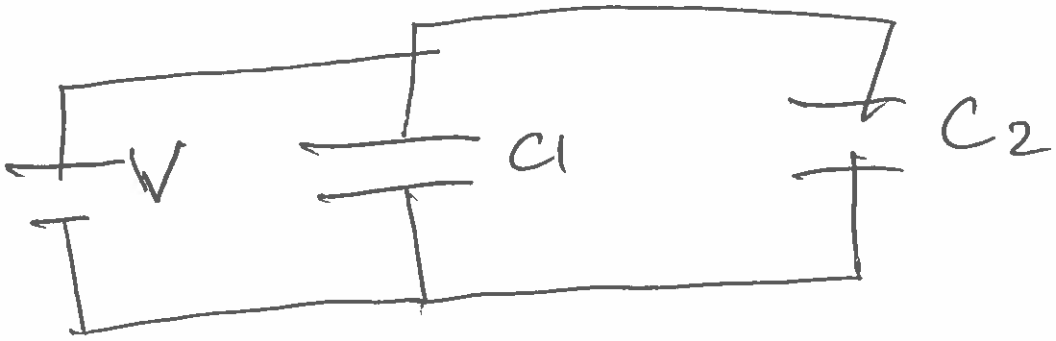
$$i = 0.385A$$

$$\Delta V_{A \to B} = (0.385A)(11\Omega)$$

$$= +4.235\ V$$

$$= +4.235\ V$$

Capacitors in Series / Parallel



$Q_1 = C_1 V \qquad Q_2 = C_2 V$

$Q_{TOT} = Q_1 + Q_2 = C_1 V + C_2 V$

$C_{TOT} V = C_1 V + C_2 V$

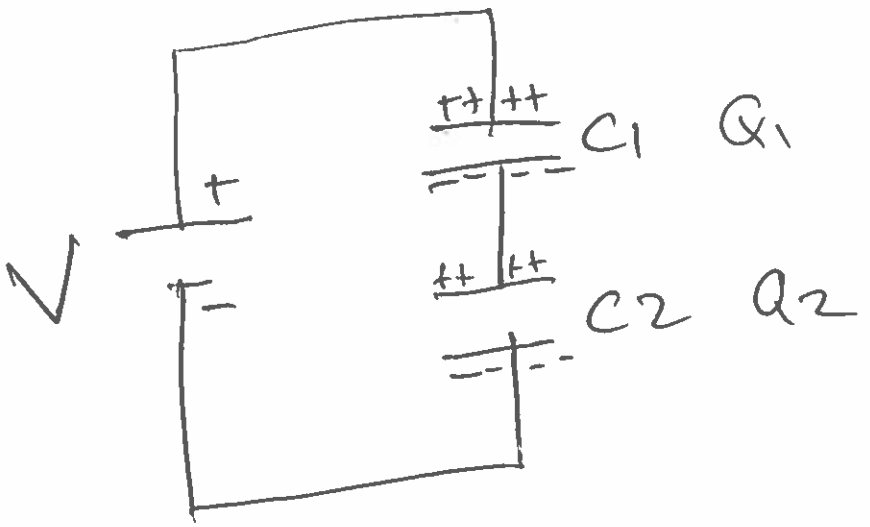
$$C_{TOT\ Parallel} = C_1 + C_2$$

If $C_1 = 5\mu F \quad C_2 = 10\mu F$

$C_{TOT} = C_1 + C_2 = 5\mu F + 10\mu F$

$$C_{TOT} = 15\mu F$$

in Series



$Q_1 = Q_2$

$$V_1 = \frac{Q}{C_1} \qquad V_2 = \frac{Q}{C_2}$$

$$V_{TOT} = V = V_1 + V_2$$

$$\frac{Q}{C_{TOT}} = \frac{Q}{C_1} + \frac{Q}{C_2}$$

$$\frac{1}{C_{TOT}} = \frac{1}{C_1} + \frac{1}{C_2}$$

C_{TOT} Series

Capacitors

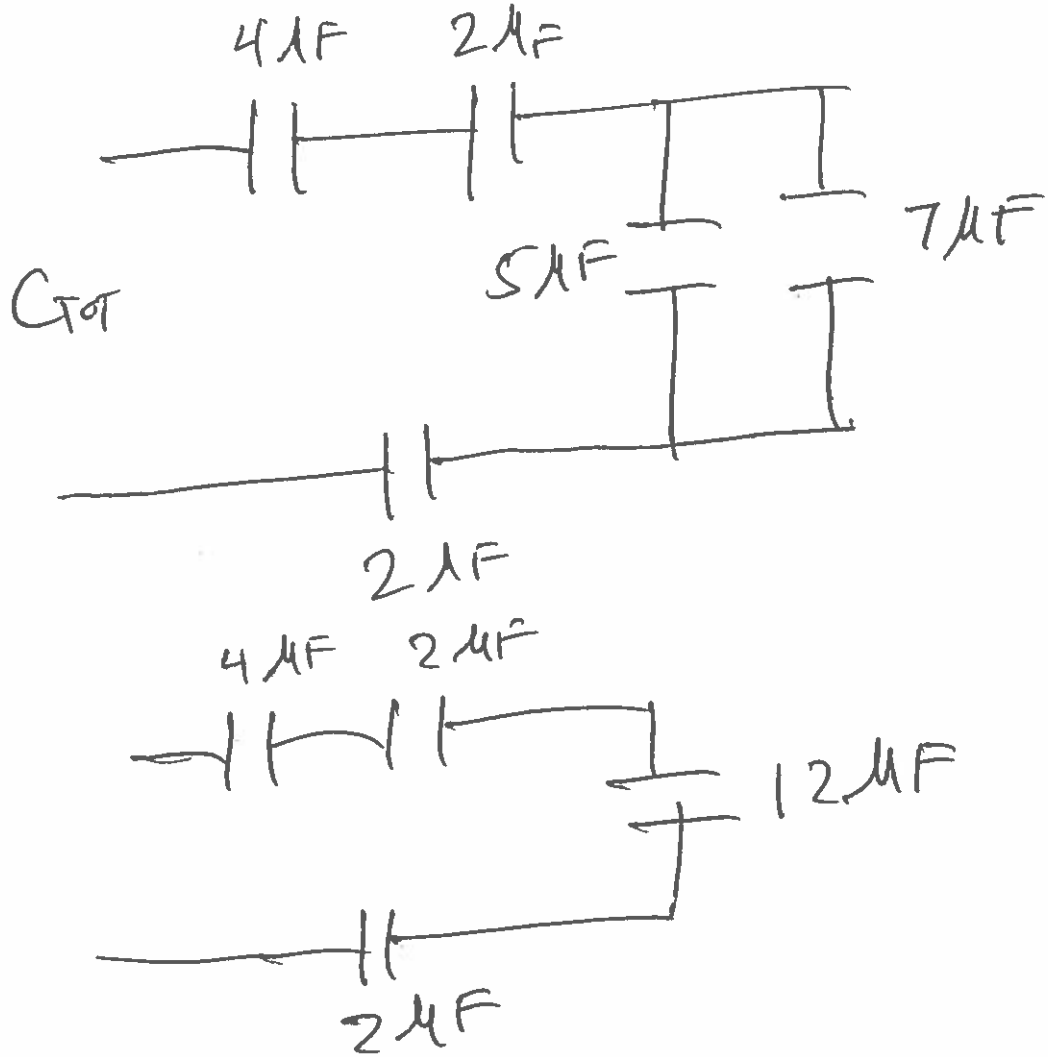
Series $\frac{1}{C_{TOT}} = \frac{1}{C_1} + \frac{1}{C_2} + \cdots + \frac{1}{C_n}$

Parallel $C_{TOT} = C_1 + C_2 + \cdots + C_n$

Resistors

Series $R_{TOT} = R_1 + R_2 + \cdots + R_n$

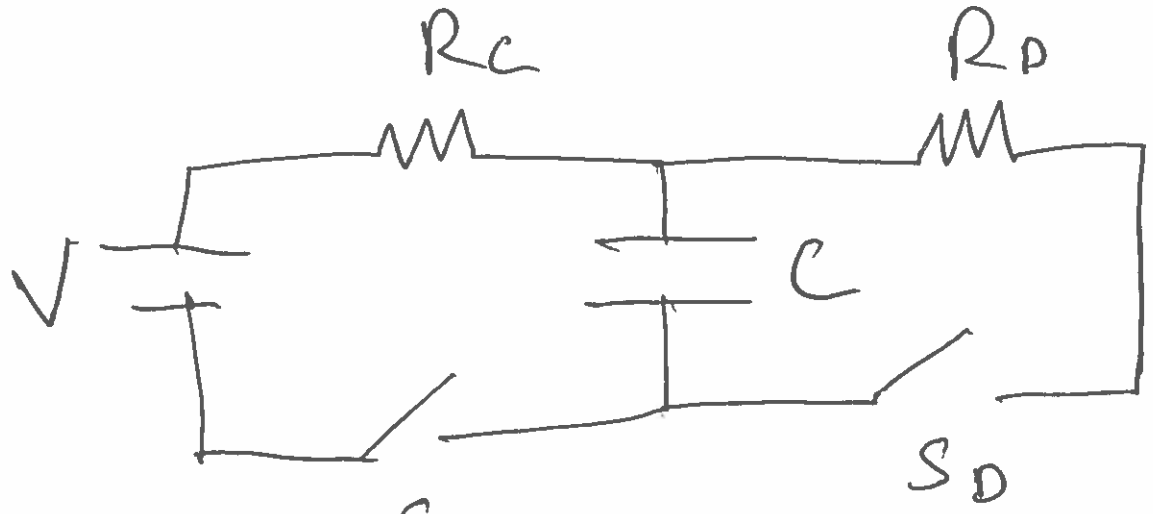
Parallel $\frac{1}{R_{TOT}} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_n}$



$$\frac{1}{C_{eq}} = \frac{1}{4\mu F} + \frac{1}{2\mu F} + \frac{1}{12\mu F} + \frac{1}{2\mu F}$$

$$\frac{1}{C_{eq}} = \frac{3+6+1+6}{12\mu F} = \frac{16}{12\mu F}$$

$$C_{eq} = \frac{12\mu F}{16} = \boxed{\frac{3}{4}\mu F}$$



Charges Capacitor

Discharges Capacitor

Charging $Q(t) = Q_f\left(1 - e^{-t/R_C C}\right)$ $\quad Q_f = CV$

$e^{-1} = \sim 0{,}37 \Rightarrow t = R_C C = \tau$

τ is Capacitive Time Constant

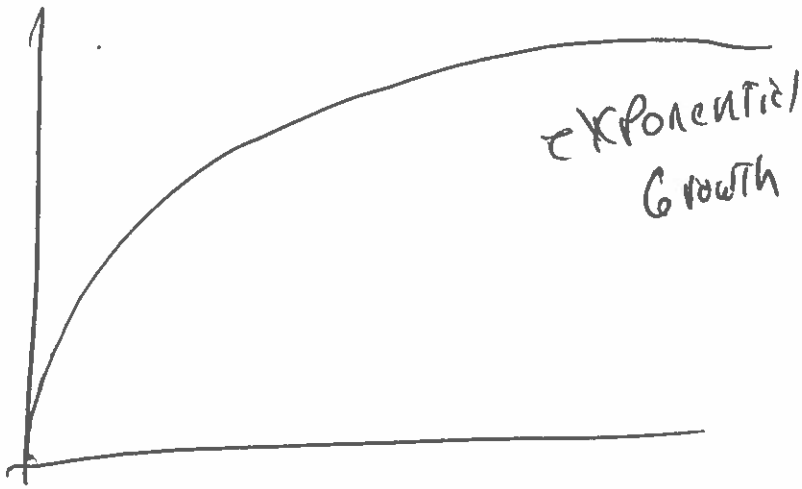
$\tau = RC = (1000\Omega)(10{,}000\,\mu F)$

$\tau = (10^3)(10^4 \times 10^{-6})\ \Omega F$

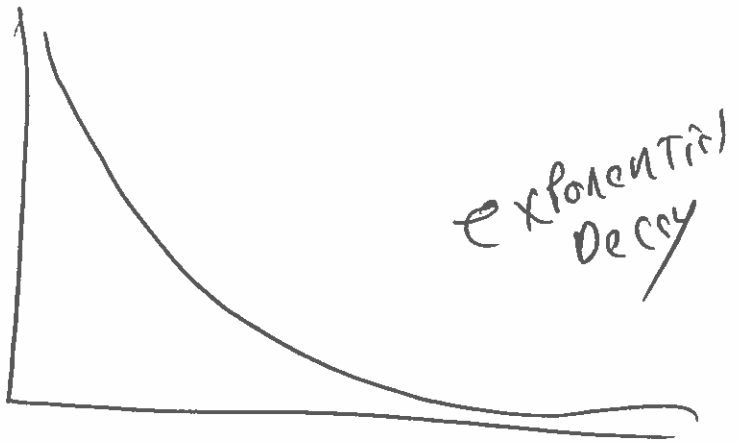
$\tau = 10\,S$

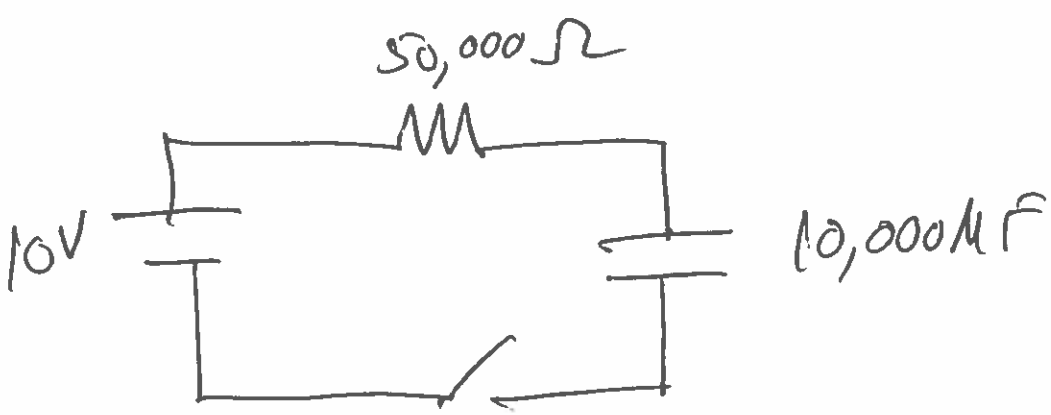
Discharging $Q(t) = Q_f e^{-t/R_D C}$ $Q_f = CV$

Charging



Discharging





$Q = ?$ after $t = 30\,s$?
$= 1000\,s$?

$Q = Q_0\left(1 - e^{-t/RC}\right)$

$Q_0 = (10{,}000\,\mu F)(10\,V)$
$= 100{,}000\,\mu C$
$= 0.10\,mC$

$Q(t=30s) = (0.10\,mC)\left(1 - e^{-30\,s/(50{,}000\,\Omega)(10{,}000 \times 10^{-6}}\right)$

$Q(t=30s) = 5.8\,mC$

$Q(t=1000s) = 86\,mC$