26-47. At the instant the switch is closed the charge on each capacitor is zero, so the voltage drop across the capacitor is also zero, and the capacitor acts as a wire—a 'short circuit'— i.e., zero voltage difference with the current going to charge the capacitor. Resistors connected in parallel to such capacitors draw zero current as $\Delta V = 0$. At long times each capacitor will be saturated, no current will flow through it; it will act as a disconnected wire ('open circuit')

(a) The circuit, with each capacitor replaced with a wire, becomes: $75+(50\|25)+15 = 75+50\cdot25/75+15 = 106.67\ \Omega$. The current is $I = V/R_{eq} = 100/106.67 = 0.938$ A.

(b) The circuit, with each capacitor deleted, becomes: $25+75+25+25+15 = 165\ \Omega$. The current is $I = V/R_{eq} = 100/165 = 0.606$ A.

26-49. Note that the time constant is $\tau = RC = 0.0147$ s, the charging capacitor follows: $q = C\mathcal{E}\left(1-e^{-t/\tau}\right)$, the discharging $q = Q_0 e^{-t/\tau}$.

(a) Note that $t/\tau = .01/0.0147 = 0.6803$:

$$q = C\mathcal{E}\left(1-e^{-t/\tau}\right) = 1.5\times10^{-5}\cdot18\left(1-e^{-0.6803}\right) = 1.33\times10^{-4}\ \text{C}$$

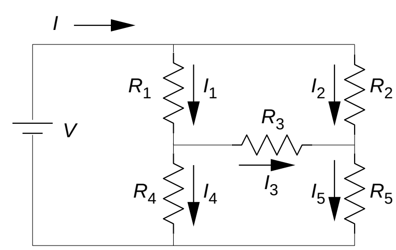
(b) $V_C = q/C = 1.33\times10^{-4}/1.5\times10^{-5} = 8.88$ V; $V_R = \mathcal{E} - V_C = 9.12$ V

(c) Both are 8.88 V: the voltage goes up 8.88 V across the capacitor, and down 8.88 V across the resistor.

(d) For this additional time increment: $t/\tau = .01/0.0147 = 0.6803$:

$$q = Q_0 e^{-t/\tau} = 1.33\times10^{-4} e^{-0.6803} = 6.75\times10^{-5}\ \text{C}$$

26-64. My plan is to use I_1, I_2, and I_3 as independent variables and immediately substitute $I_4 = I_1 - I_3$ and $I_5 = I_2 + I_3$ into the loop equations. I'll use as independent loops the outer loop L_0 , the top loop L_T, and the left loop L_L. The results are (respectively):



$$\begin{aligned}
\mathcal{E} - I_2R_2 - (I_2+I_3)R_5 &= 0\\
-I_2R_2 + I_3R_3 + I_1R_1 &= 0\\
\mathcal{E} - I_1R_1 - (I_1-I_3)R_4 &= 0
\end{aligned}$$

I'll rewrite these in more standard form as:

$$\begin{aligned}
\mathcal{E} &= I_2(R_2+R_5) + I_3R_5\\
0 &= I_1R_1 - I_2R_2 + I_3R_3\\
\mathcal{E} &= I_1(R_1+R_4) - I_3R_4
\end{aligned}$$

Note that a program like *Mathematica* can immediately solve these equations symbolically with a command like:

```
Solve[{e==i2(r2+r5)+i3 r5,0==i1 r1-i2 r2+i3 r3,e==i1(r1+r4)-i3 r4},{i1,i2,i3}]
```

and result:

```
               e (r3 r5 + r2 (r3 + r4 + r5))
-----------------------------------------------------------------
r4 (r3 r5 + r2 (r3 + r5)) + r1 ((r3 + r4) r5 + r2 (r3 + r4 + r5))

                e (r3 r4 + r1 (r3 + r4 + r5))
-----------------------------------------------------------------
r4 (r3 r5 + r2 (r3 + r5)) + r1 ((r3 + r4) r5 + r2 (r3 + r4 + r5))

                     e (r2 r4 - r1 r5)
-----------------------------------------------------------------
r4 (r3 r5 + r2 (r3 + r5)) + r1 ((r3 + r4) r5 + r2 (r3 + r4 + r5))
```

Do notice the important result that $I_3 = 0$ iff $R_2 R_4 = R_1 R_5$ (this condition is more commonly written $R_2/R_5 = R_1/R_4$). However, my calculator needs numbers not letters, so I enter the system of equations:

$$\begin{aligned} 14 &= 3I_2 + I_3 \\ 0 &= I_1 - 2I_2 + I_3 \\ 14 &= 3I_1 - 2I_3 \end{aligned}$$

and find: $I_1 = 6$ A, $I_2 = 4$ A, $I_3 = 2$ A $\Rightarrow I_4 = I_1 - I_3 = 4$ A, $I_5 = I_2 + I_3 = 6$ A and the battery draws: $I = I_1 + I_2 = 10$ A.

The equivalent resistance is easily found from the battery voltage/current: $R = V/I = 14/10 = 1.4\ \Omega$.