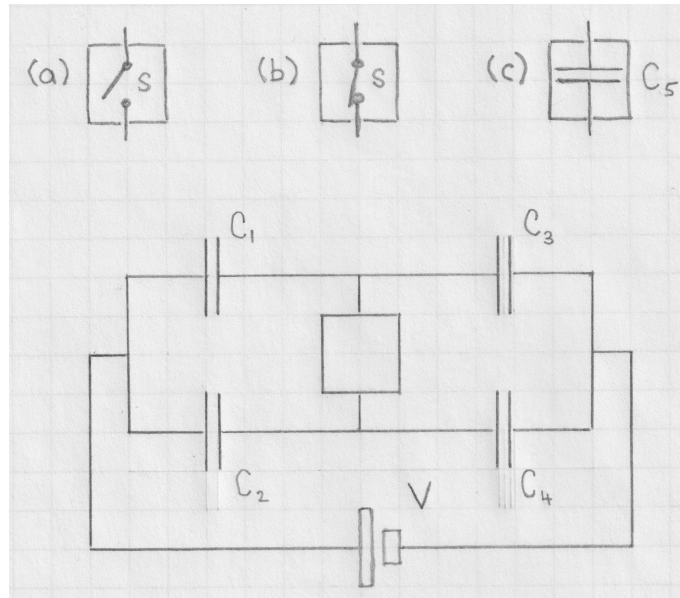


[lex34] Capacitor circuit

The specifications of the capacitor circuit shown in three versions are $V = 12\text{V}$, $C_m = m\ \mu\text{F}$, $m = 1, \dots, 5$. All capacitors have been discharged when the circuit is connected to the battery. Find the charge Q_m on each capacitor once equilibrium has been established. Find also the equivalent capacitance of a single capacitor that mimics the function of the multi-capacitor configuration in each version.

- For versions (a) and (b), reduce the configuration in two steps to a single capacitor to find the equivalent capacitance. Then reverse the reduction to find the charges on each capacitor.
- For version (c), derive five linear equations using the conductor rule and the loop rule for the five unknown Q_m and solve them. Infer the equivalent capacitance from the charge that flows through the battery when the capacitors are being charged up and the voltage across it.
- Use the same equations in the limit $C_5 \rightarrow 0$ to recover the results of version (a) and in the limit $C_5 \rightarrow \infty$ to recover the results of version (b).



Solution: