Exam II Review

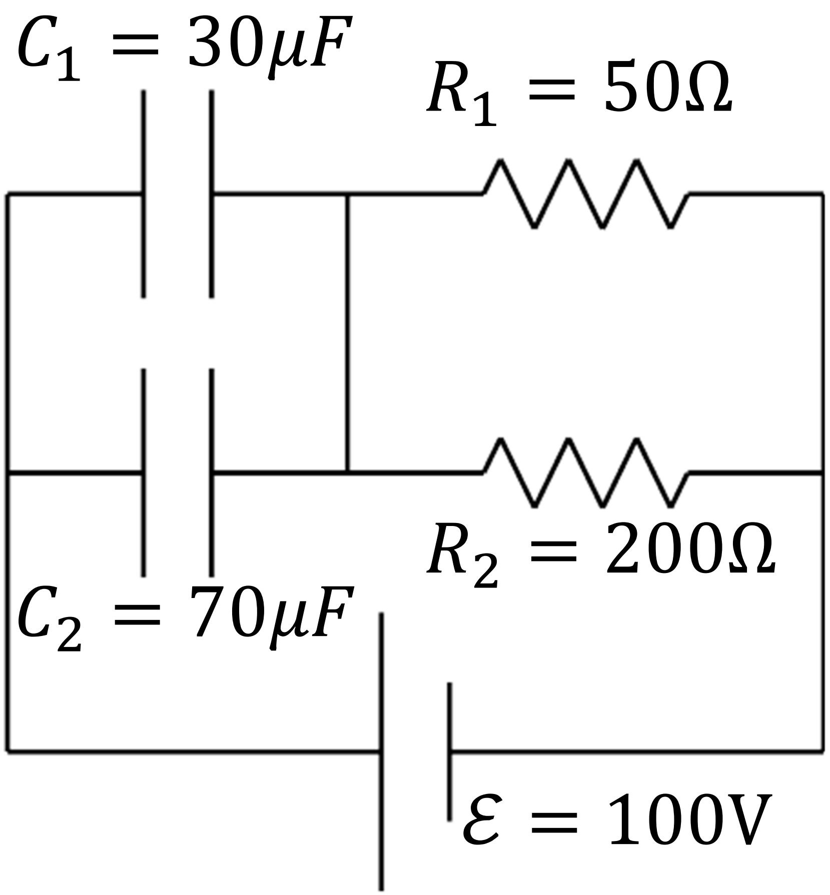
- Dielectrics
- Resistivity
- Resistance
- Circuits
- RC Circuits
- Magnetism
- Lorentz Forces
- Magnetic Dipoles

Example: An circular air-filled parallel plate capacitor is connected to a battery with emf, $\mathcal{E}$. The capacitor has a radius, R, and plate separation, d. (a) Determine the charge on the capacitor and the energy stored in the capacitor.

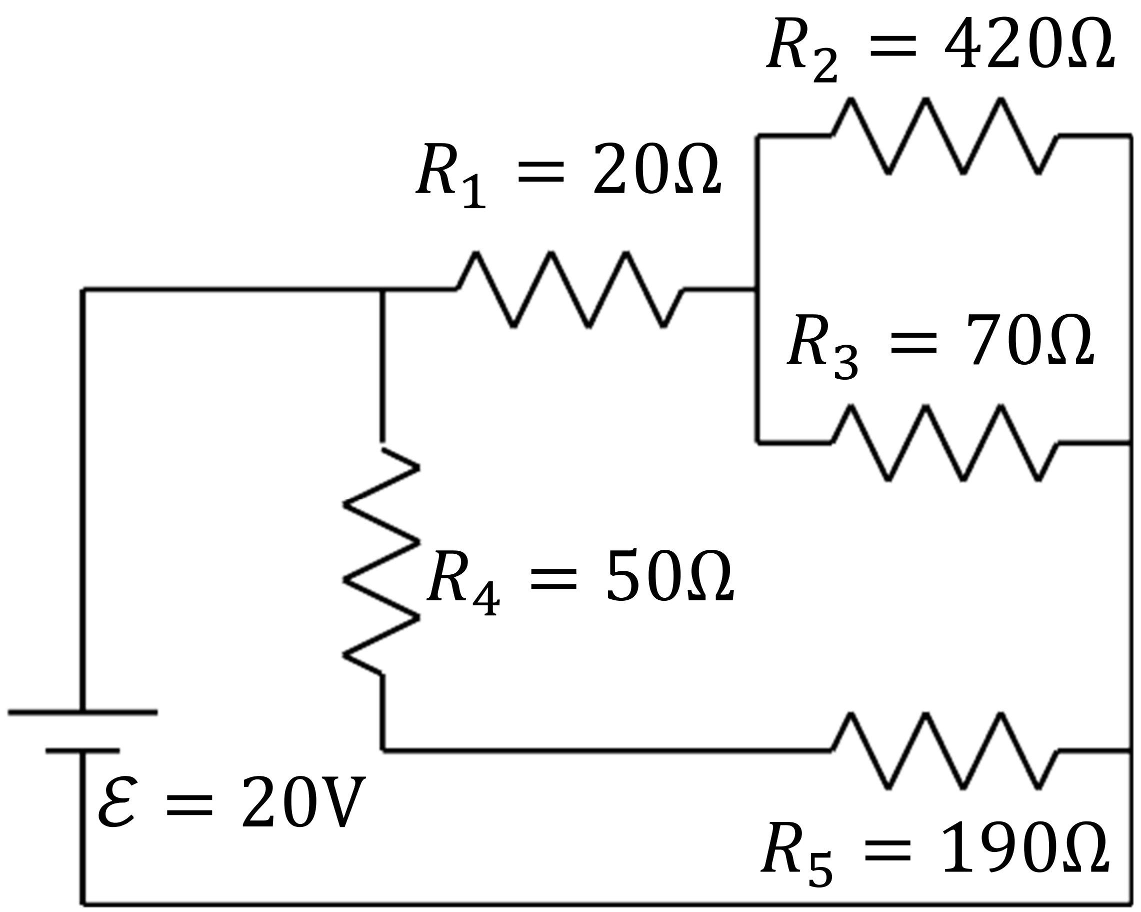
Example: An circular air-filled parallel plate capacitor is connected to a battery with emf, $\mathcal{E}$. The capacitor has a radius, R, and plate separation, d. (a) Determine the charge on the capacitor and the energy stored in the capacitor. (b) The gap is filled with an insulator with dielectric constant, κ. Determine the charge on the capacitor and the energy stored in the capacitor. [Still connected to battery.]

Example: A circuit of Nichrome wire normally carries a current, $2\mathrm{A}$, at room temperature, $20°\mathrm{C}$. The circuit is cooled to $-30°\mathrm{C}$. Determine the current through the circuit at $-30°\mathrm{C}$. $\rho_N = 1 \times 10^{-6}\Omega\mathrm{m}$, $\alpha_N = 4 \times 10^{-4}/°\mathrm{C}$.

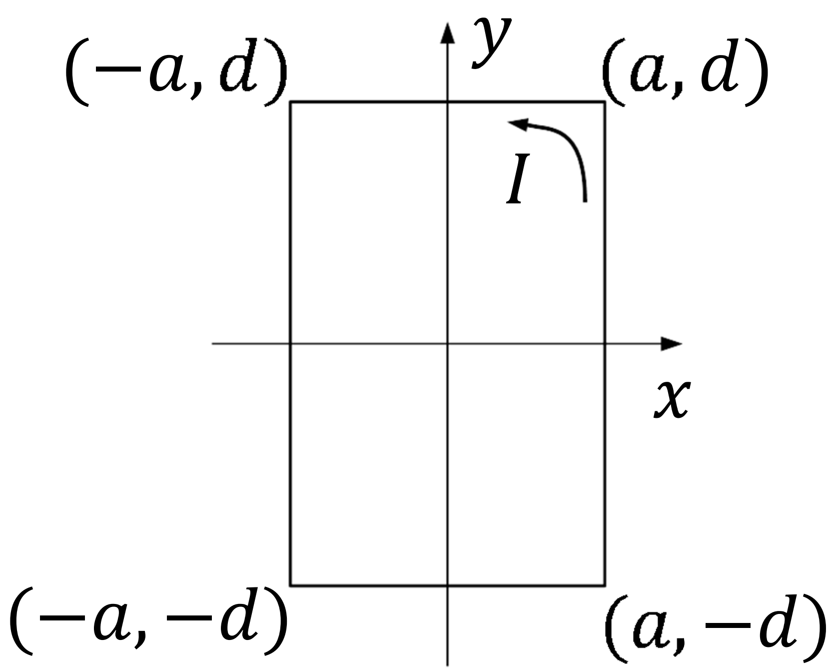
Example: The capacitors in the given circuit are initially uncharged. The battery is connected at $t = 0s$. (a) Determine the time required to reach 86.5% of full charge on the capacitors. (b) What is the potential difference across the resistors at the time found in part (a)? $[\ln(0.135) = -2.00]$



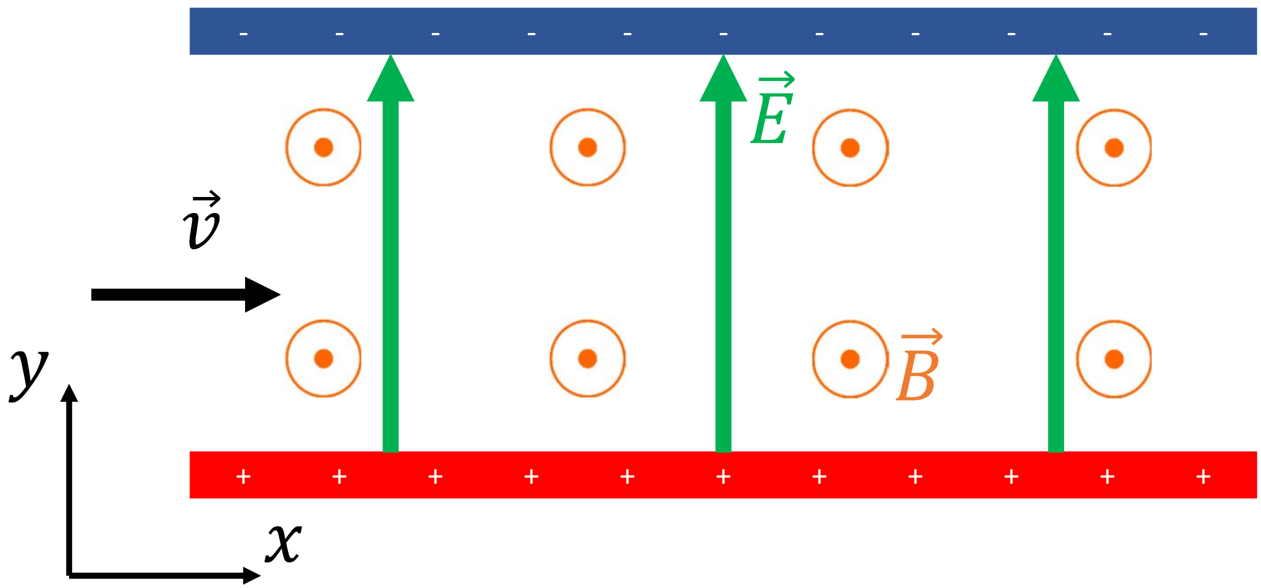
Example: For the given circuit, determine R_T and I_5.



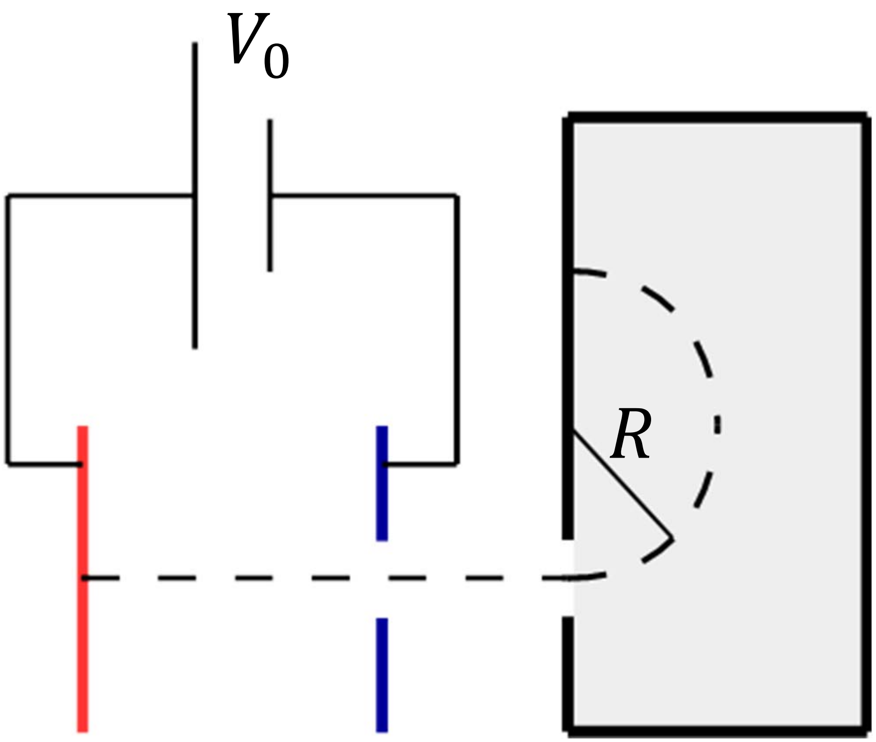
Example: A rectangular conducting loop lies in the *xy*-plane with corners at (x, y) coordinates $(-a, -d)$, $(-a, d)$, $(a, -d)$ and (a, d). The magnetic field in the region is $\vec{B} = (b_1 x + b_2 y)\hat{k}$. A current, I, flows counterclockwise in the loop, as illustrated. Determine the net force and net torque on the loop. a, d, b_1 and b_2 are positive quantities.



Example: The velocity selector shown allows charged objects with a velocity of $\vec{v}_0$ to pass through un-deflected. What is the initial acceleration (magnitude and direction) of a proton entering the region with a velocity of $\frac{1}{2}\vec{v}_0$? Answer in terms of m, e and E.



Example: Alpha particles ($m_\alpha = 4m_p$, $q_\alpha = 2e$) are accelerated through a potential difference, V_0, and then pass through a magnetic field perpendicular to their velocity. What magnetic field (magnitude and direction) should be used to produce a radius of curvature, R, in the direction shown?



Example: A galvanometer has a square loop of 400 turns with sides of 1cm. A current of 2.0A causes a deflection of $30°$. At this deflection, the restoring spring provides a torque, $\tau = 1.2 \times 10^{-4}\text{Nm}$. Assuming the magnetic field in the region of the loop is uniform, what is magnitude of the field?