

Wednesday Reading Assessment: Unit 1, DC Circuits

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February 7, 2024

1 Memory Bank

- $C = A\epsilon_0/d$... Capacitance of a parallel-plate capacitor.
- $\epsilon_0 = 8.85 \times 10^{-12}$ F/m
- $C_{tot}^{-1} = C_1^{-1} + C_2^{-1}$... Total capacitance of two capacitors in series.
- $I = \Delta Q/\Delta t$... Definition of current.
- $\Delta V = IR$... Ohm's Law, relating resistance R , current I , and voltage ΔV .

2 Capacitors and Capacitance

1. Suppose you have a parallel plate capacitor with $A = 1 \text{ mm}^2$, and $d = 0.1 \text{ mm}$. What is the capacitance?
2. Now suppose two identical capacitors from the previous problem are added *in series*. What is the total capacitance?
3. Which of the following should be the formula for the capacitance of a coaxial cable of length L ? The inner and outer radii are R_1 and R_2 , respectively. *Think about the units of ϵ_0 .*
 - A: $C = (2\pi\epsilon_0 R_1 L)/\ln(R_2/R_1)$.
 - B: $C = (2\pi\epsilon_0 L)/\ln(R_2/R_1)$.
 - C: $C = (2\pi\epsilon_0 R_1 R_2 L)/\ln(R_2/R_1)$.
 - D: $C = (2\pi\epsilon_0 L)$.

3 Current, Resistance, and Ohm's Law

1. The definition of one “amp” of current is 1 Coulomb per second. How many milliamps of current correspond to 1 μC of charge flowing down a 10 cm wire in 1 hour?
2. Suppose a 12 V battery drives 100 mA of current through a resistor with resistance R . Calculate the value of R .
3. If R in the system in the previous exercise was doubled, and ΔV kept constant, what would be the new current?