

Test II Study Guide

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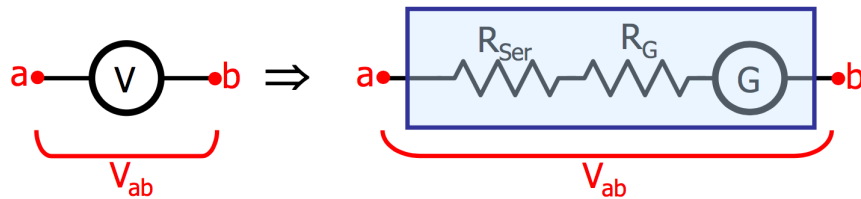
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1 Notes

- If a dielectric fills one half of the space between plates, it's the same as two capacitors in parallel — one with a dielectric, one not.
- Current is in the direction of flow of **positive charge**.
- Materials that are ohmic have a linear I vs. V graph.
 - Anything else (like quadratic) are nonohmic.
- For resistors **in series**,
 - $R_{eq} = \sum_i R_i$ (opposite of capacitors)
 - Currents I is the same (same as capacitors)
 - V 's add (same as capacitors)
- For resistors **in parallel**,
 - $\frac{1}{R_{eq}} = \sum_i \frac{1}{R_i}$ (opposite of capacitors)
 - Currents I is the same (same as capacitors)
 - V 's add (same as capacitors)
- Power = $\frac{\text{Energy Transformed}}{\text{Time}}$
- Kirchhoff's Junction Rule: at any junction point, the sum of all currents entering the junction must equal the sum of all currents leaving the junction.

- Kirchhoff's Loop Rule: the sum of the changes of potential around any closed path of a circuit must be zero.

To reduce the percent error, the device being used as a voltmeter must have a very large resistance, so a voltmeter can be made from galvanometer in series with a large resistance.

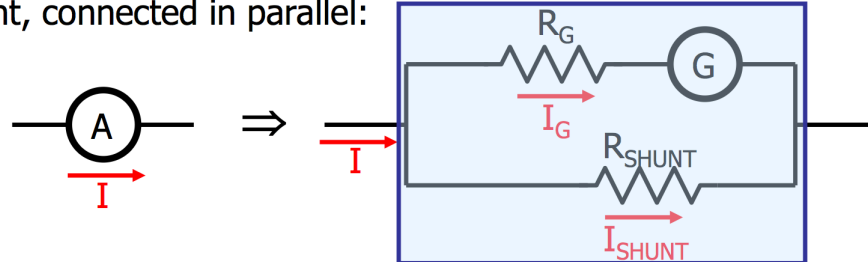


Everything inside the blue box is the voltmeter.

Homework hints: "the **galvanometer** reads 1A full scale" would mean a current of $I_G=1A$ would produce a full-scale deflection of the galvanometer needle.

If you want the **voltmeter** shown to read 10V full scale, then the selected R_{ser} must result in $I_G=1A$ when $V_{ab}=10V$.

A galvanometer-based ammeter uses a galvanometer and a shunt, connected in parallel:



Everything inside the blue box is the ammeter.

The resistance of the ammeter is

$$\frac{1}{R_A} = \frac{1}{R_G} + \frac{1}{R_{SHUNT}}$$

$$R_A = \frac{R_G R_{SHUNT}}{R_G + R_{SHUNT}}$$

- For charging a circuit, $I(t) = \frac{\varepsilon}{R} e^{-\frac{t}{RC}}$
- For discharging a circuit, $I(t) = I_0 e^{-\frac{t}{RC}}$
 - I_0 for charging is equal to I_0 for discharging only if the discharging capacitor was fully charged.
- In a series RC circuit, the same current I flows through both the capacitor and the resistor. Sometimes this fact comes in handy.
- Ohm's law **only** applies to resistors, not capacitors.
- Magnetic field lines point away from north, towards south.
 - Same notation as electric fields!
- In a uniform magnetic field, force is always radially outward. Therefore, $a = v^2/r$.

- Period $T = \frac{2\pi r}{v}$. (However, easier to remember distance = velocity · time $\implies T = \frac{\text{distance}}{\text{velocity}}$)
- frequency = $\frac{1}{T}$

2 Units

- Resistance: $1\Omega = \frac{1V}{1A}$
- Resistivity: $\rho = \Omega \cdot m$
- Magnetic field: $1T = \frac{1\text{kg}}{\text{C}\cdot\text{s}}$
- Older unit: $1\text{G} = 10^{-4}\text{T}$

3 Unit Prefixes

| | |
|------------|-----------------|
| 10^{-15} | femto (f) |
| 10^{-12} | pico (p) |
| 10^{-9} | nano (n) |
| 10^{-6} | micro (μ) |
| 10^{-3} | milli (m) |
| 10^{-2} | centi (c) |
| 10^{-1} | deci (d) |