Test II Study Guide

Illya Starikov

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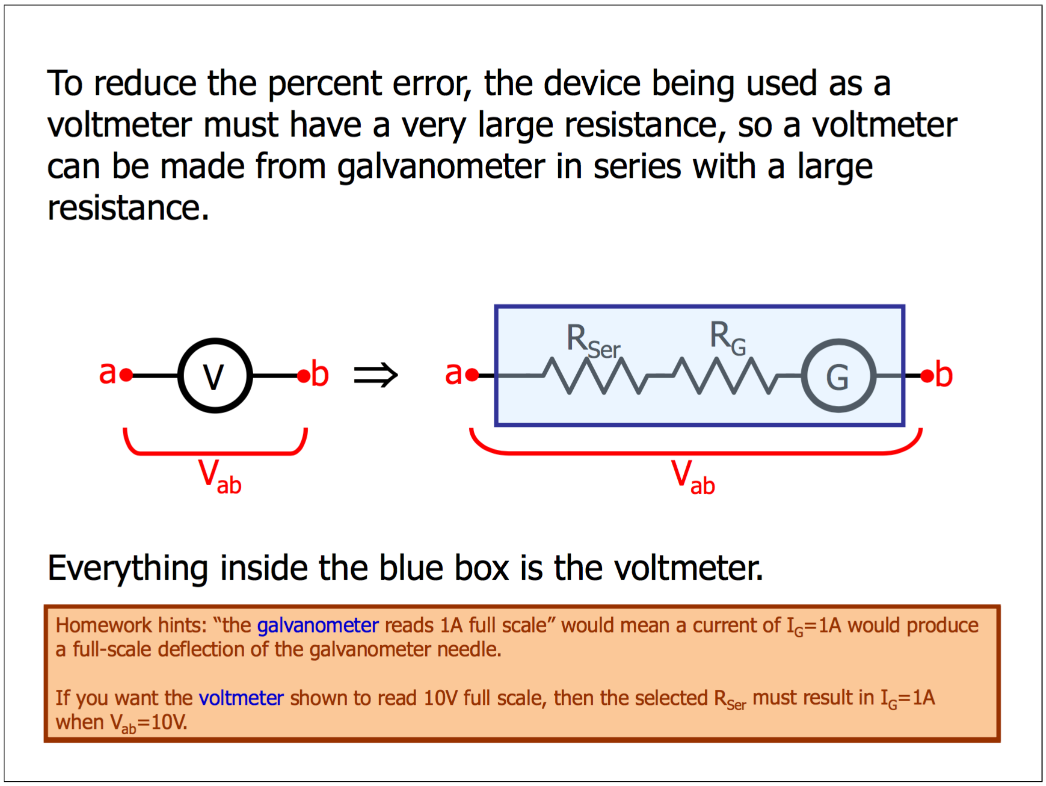
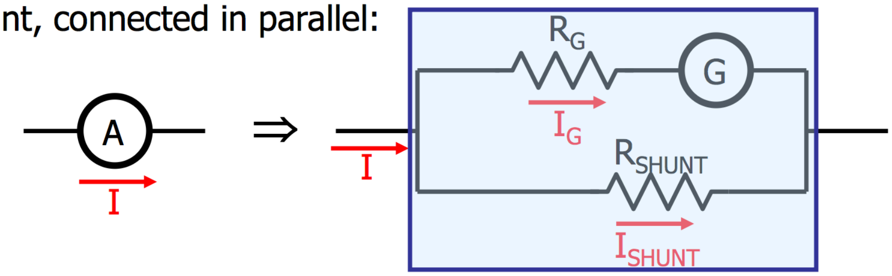
1 Notes

- If a dielectric fills one half a 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.



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$\cdot$ 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)