Duke University
Department of Physics

Physics 271 Spring Term 2017

WUN2K FOR LECTURE 1

These are notes summarizing the main concepts you need to understand and be able to apply.

DC circuits

- Current describes movement of charge: $I = \frac{dq}{dt}$.
- Potential V is potential energy per charge (gravitational potential is a good analogy). We will assume that potential is the same anywhere inside a conductor. In particular, we'll assume it's the same everywhere in a wire.
- An "electromotive force (EMF)" (not strictly a force) ε is a charge pump that maintains a potential across a conductor. An ideal EMF or voltage source maintains a fixed potential. We approximate a battery, power supply *etc.* as an ideal voltage source in series with an internal resistance.
- Ohm's Law for linear resistors: $V = IR$ (it is *not* a universal law). The resistance R depends on the properties of the object: $R = \frac{\rho l}{A}$, where ρ is resistivity (property of the material), l is the length, and A is the cross-sectional area.
- Power dissipated in a circuit (generally to heat) according to $P = VI$. For an Ohm's Law case, $P = I^2R$ through a resistor.
- Resistors in series can be treated as an equivalent resistance $R_{\text{eq}} = \sum_i R_i$. Two resistors R_1 and R_2 in parallel can be treated as an equivalent resistance $R_{\text{eq}} = \frac{R_1 R_2}{R_1 + R_2}$.

Remember that abstractions are leaky! (but useful).