Physics 152 Summary IV

1) Kirchoff's Laws: (Know the sign conventions)
   i) Sum of ΔV around any closed loop must be zero.
   ii) Sum of currents entering any junction must equal the sum of currents leaving the junction.

2) "$V = IR$"

   resistors in series: $R_{eq} = R_1 + R_2$

   resistors in parallel: $\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}$

3) $P = IV = I^2R = \frac{V^2}{R}$

4) $Q = CV$

   parallel plate capacitor: $C = \frac{\epsilon_0 A}{d}$

   - capacitors in parallel: $C_{eq} = C_1 + C_2$
   - capacitors in series: $\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2}$
   - Know when charge is conserved, etc..., like the homework and problems we solved in class.
   - Understand how to calculate capacitance, C, for a given configuration of conductors.
   - $U = \frac{Q^2}{2C}$

5) Inductors: $\mathcal{E}_L = -L\frac{dI}{dt}$, $L = \frac{N\Phi_B}{I}$

   - understand the direction of the induced emf.
   - Know how to derive L for simple geometries like solenoids ($\mathcal{E} = -\frac{d\Phi_B}{dt}$)
   - $U_B = \frac{1}{2}LI^2$

6) Capacitors and Inductors in D.C. circuits:

C: $\tau = RC$ $\quad Q(t) = \mathcal{E}C\left(1 - e^{-t/\tau}\right)$

$Q(t) = Q_0 e^{-t/\tau}$ ← Know why these are different & which one to use.

- Know how to find $I(t)$ from $Q(t)$.
- understand conceptually how capacitors behave in DC circuits.

L: $\tau = R/L$ $\quad I(t) = \frac{\mathcal{E}}{R}\left(1 - e^{-Rt/L}\right)$

- understand where above equations come from.
- understand conceptually how inductors behave in RL circuits.

7) Mutual Inductance: $M_{21} = \frac{N_1 \Phi_{21}}{I_2}$, $\mathcal{E}_2 = -M_{12}\frac{dI_1}{dt}$

how is this useful?

8) LC Circuit:

$\omega = \frac{1}{\sqrt{LC}}$ $\quad q = Q_{max}\cos\omega t$

$i = -I_{max}\sin\omega t$

$$\frac{Q_{max}^2}{2C} = \frac{L I_{max}^2}{2}$$

- Can you show that energy is conserved?

9) LRC circuit:

Know qualitatively how a resistor changes the behavior of the LC circuit.