**Circuits I: (without inductance):**

Resistors (Ohm’s Law): Power: 



Kirchhoff’s Rules:

1. *Junctions:* “”, 2. Loops: 

Resistors in parallel:  …in series: 

Capacitors:



Capacitors in parallel:  … in series: 

RC Circuits: Time constant: 

Discharging or charging:

Often: or

**Magnetism:** Forces: 

Magnetic fields from currents: A distance *r* from a straight wire: 

At the center of a loop of wire of radius *R*: 

In a cylindrical coil (or inductor): 

Torque on a loop of wire: where

**Inductance:** ** ,** and for a cylindrical inductor

For an LC circuit (capacitor and inductor):

 and 

**Maxwell’s equations:**

**Gauss’ law (for and ) and**

**Faraday’s law:**  or

**Ampere-Maxwell law:**

**Harmonic oscillators:**

Angular frequency: 

SHO Equation:

Solution to SHO Equation:

where  is the natural *angular* frequency of the oscillator

Mass on a spring:  Simple pendulum: 

**Wave kinematics:**

Traveling wave:

Standing wave:

Sinusoidal wave:



**Wave dynamics:**

The wave equation: I forget…

The wave equation is either or

I can’t remember which it is, but you ought to be able to figure it out.

Velocities:



**Sound:**

Intensity and sound level (volume):



Doppler Effect for SOUND:



**Damped and/or driven harmonic oscillators:**

Damped springs: if  and 

Without a driver (motor):

With a driver (motor with angular frequency ω):



**Damped harmonic oscillators and RLC Circuits**

Springs with fluid friction:

Kinematics: and

Resonant frequency:

Damped harmonic oscillation:

, ,

RLC ***series*** circuits: 

And

Resonant frequency:

Without a driver (AC source): 

**Driven damped harmonic oscillators and AC Circuits:**

With a driver (AC source with angular frequency *ω*):

**Symbols and vocabulary for AC Circuits**

|  |  |  |
| --- | --- | --- |
| Voltage | Reactance |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Power**:

**Q Factor:** for an RLC circuit,

**Optics:**

Index of refraction: 

Reflection:  Refraction: 

Intensity: 

Polarization:

When unpolarized light passes through one polarizer: 

When polarized light passes through a second polarizer rotated at an angle of  from the first: 