RAA03 – Checklist of things to know/review

**RAA03 contains all information from lectures up to and including lecture 29: Standing waves on strings and standing sound waves in pipes. Below is a short list of important concepts to understand. The goal of this list is to help you organize your thoughts as you study. This sheet does not contain everything that we covered, just the highlights to help point you in the right direction.*

- All of RAA01 and RAA02 checklist items.
- Oscillations:
    - Defining features of oscillations
    - SHO vs non-SHO (features of SHO)
    - Potential energy functions (stable and unstable equilibrium locations)
    - General oscillator quantities (angular frequency, period, amplitude, frequency).
- Specific Oscillator systems:
    - Mass-spring system:
        - Functional form of angular frequency, period, frequency, max velocity, max acceleration, total energy.
        - Hooke's Law.
        - Spring potential energy.
        - Construct mathematical representation based off initial conditions. Also determine relevant physical quantities from mathematical representation.
        - Graphical analysis (extract relevant physical quantities from graphs and sketch position velocity and acceleration graphs if given one of the others).
    - Pendulum system:
        - Functional form of angular frequency, period, frequency, max angular velocity, max angular acceleration, total energy.
        - Construct mathematical representation based off initial conditions. Also determine relevant physical quantities from mathematical representation.
        - Graphical analysis (extract relevant physical quantities from graphs and sketch position angular velocity and angular acceleration graphs if given one of the others).
- Damped oscillations:
    - What is our model for damped oscillations? (i.e. what is the source of drag and what functional form do we assume)
    - Time constant?
    - Construct mathematical representation based off initial conditions. Also determine relevant physical quantities from mathematical representation.
    - Graphical analysis; extract relevant physical quantities from graphs (time constant, frequency, period, wavelength).
    - Logarithmic algebra.
- Traveling waves:
    - Transport energy.
    - Types (mechanical, electromagnetic, matter).
    - Modes (transverse, longitudinal, combo transverse and longitudinal).
    - Features of traveling waves (wavelength, frequency, period, wave speed).
    - What determines the frequency and energy of a traveling wave?

    - Construct mathematical representation based off initial conditions. Also determine relevant physical quantities from mathematical representation.
    - Graphical analysis:
        - Snapshot vs history.
        - Extract relevant physical quantities (period, wavelength, frequency, wave number, wave speed).
    - Wave speed vs oscillator speed.
- Traveling wave case studies:
    - Sound
        - Pressure or displacement representation
        - Type?
        - Wave speed?
    - Wave on string
        - Functional form for wave speed.
        - Type?
- Traveling waves and boundaries:
    - Which quantities remain the same, which change?
- Energy and intensity of traveling waves:
    - Energy proportional to amplitude^2.
    - Power definition. (energy/time)
    - Intensity definition (power/area)
    - Energy proportional to amplitude^2 and frequency^2.
    - What determines energy of traveling wave?
    - Cross-sectional area of sphere vs circle. (Circular source of wave vs laser like sources).
    - Sound intensity level.
    - Logarithmic algebra to extract relevant quantities from sound intensity level mathematical expression.
    - Threshold of human hearing.
- Doppler effect:
    - Construct mathematical representation based off relative motion and determine relevant quantities.
    - Graphical representation of observed frequency.
- Superposition of waves:
    - Construct superposition of two interfering waves.
    - Constructive vs destructive.
- Standing waves:
    - Boundary conditions…. Symmetric vs anti-symmetric.
    - Sketch standing wave patterns for strings and sound waves.
    - Extract relevant physical quantities from standing wave pattern.
- Lab skills:
    - Graphing linear lines and matching plot with a physical mathematical model to extract relevant quantities.
    - Estimating uncertainty with graphs and data