Oscillations and Waves Oral Presentations

Goal Week 1: Collect data on your assigned project & generate any and all plots required (with proper formatting).
Goal Week 2: Prepare your presentation.
Goal week 3: Present to the class. Instructor selects order at random on the day of the talks. Be ready to go first!

Option	Topic	Brief summary of results required
1a	Standing waves on strings *Similar* (but not *identical*) to **part 1** of this handout	Fix length of string and string tension. Sweep frequency. Plot harmonic number versus frequency for the lowest *five* harmonics. Repeat with half the length of string but same tension. Repeat again using half the string tension and the original length. Compare results to theoretical predictions.
1b	Standing waves on strings *Similar* (but not *identical*) to **part 2** of this handout	Fix length of string and oscillation frequency. Sweep the tension by varying the hanging mass. Plot harmonic number versus hanging mass for the lowest *five* harmonics. Repeat with different string length with same frequency. Repeat again using half oscillation frequency with original length. Compare results to theoretical predictions.
2a	Standing sound waves in tubes *Similar* (but not *identical*) to **part 2** of this handout	Set speaker at one end of the resonance tube apparatus. Sweep frequency to find at least *eight* resonance frequencies when tube is closed at the other end. Repeat the experiment using the larger cardboard tube (also closed at the other end). Plot frequency versus tube length to determine speed of sound. Remember to account for effective length. Include a slide explaining what effective length is. Include a brief conceptual explanation of the physics behind effective length in your talk!
2b	Standing sound waves in tubes *Similar* (but not *identical*) to **part 2** of this handout	Set speaker at one end of the resonance tube apparatus. Sweep frequency to find at least *eight* resonance frequencies when tube is open at the other end. Repeat the experiment using the larger cardboard tube (also closed at the other end). Plot frequency versus tube length to determine speed of sound. Remember to account for effective length. Include a slide explaining what effective length is. Include a brief conceptual explanation of the physics behind effective length in your talk!
3	Mass-spring oscillations *Similar* (but not *identical*) to this handout	Use plots of distance stretched versus hanging mass to determine the spring constants of 4 springs. Then attach a spring to each end of an air track glider. Place the glider on a *leveled* air track such that the springs make the glider oscillate. Record the oscillation period. Now add 100 grams of mass to the glider (symmetrically loaded). Record the new period. Add another 100 g of mass to the glider. Record the new period. Record three more period measurement (for all three masses) using two springs in *parallel* on each end. Record three more period measurement (for all three masses) using two springs in *series* on each end.

4	Torsional pendulum Similar to this experiment	Might be good for a mathy group? Explain the derivation of the "torsion constant for a solid cylindrical wire". Ensure your explanation is as short as possible while still ensuring students in the class can follow. You can do a better job than that link for sure. While one person works up the derivation, the others determine the period of various cylindrical wires oscillating with various moments of inertia. Ideally you try out 5 moments of inertia for at least 3 different solid cylindrical wires. You should be able to produce three plots of period versus moment of inertia and get experimental values of the torsion constant for each of the three wires. Compare these values to the predicted value from your theory person's work.
5	Similar to this experiment	Determine the spring constant of the Wilberforce pendulum. Precisely record period of oscillation for Wilberforce in torsional pendulum mode for at 15 possible positions of the adjustable masses (always symmetrically loaded). Compare the predicted resonant frequencies of the mass spring system to the torsional system. Show videos of the predicted best positions.
6		Hoop with lumps of clay on it every 30 degrees. Predict oscillation period and compare to experimental results. Derive Moment of inertia for hole with two lumps of clay at arbitrary angle. Hint: it may help to look up "central versus inscribed angle". Remember to cite any sources used! Explain this tricky bit of math to the class.
7	Not much of a handout, but it gets you started	Vertical spring oscillations standing waves. We'll have to talk about expectations once you get it running. To be fair to other groups, you'll need to try several lengths of spring and search for maybe 7-8 resonances for each spring length. In addition, you must quantify the tension with either a force sensor or calibrating with hanging masses.
8		Resonance strips & Chladni Plates? Use as an extra option if we run out.
9		Standing waves on hoops? Use as an extra option if we run out.
Code 1		Square plate with pivot at one corner. Determine oscillation periods for release angles of $5°, 10°, 20°, 45°, \& 90°$ angles using Euler Cromer method. Verify experimentally with real square plate. Hopefully you can show your code more accurately predicts periods for large angles ($> 10°$). Include % differences.
Code 2		Simulate hoop with lumps of clay. Compare to results from group doing Option 6.
Code 3		Simulate all cases used for mass-spring system described in Option 3. Compare to the experimental results from the group doing Option 3.