Honors Wave Machine Generator

Due Date: Thursday, May 11, 2017

Student Name_____

Design Statement and Objective:

Each student will design and build a transverse wave demonstrator. The wave demonstrator will be used for the following exploratory activities:

1) Observe mechanical wave reflection, standing waves (nodes and anti-nodes), harmonics, wave speed, and wave length.
2) Calculate wave speed.
3) Calculate frequencies and wavelengths of the first five harmonics.

Materials:

1) tape or glue (e.g. duct tape, Scotch tape, elastic ribbon, bonding glue)
2) string or rope
3) minimum 40 cross bars (e.g. skewers, dowel rods, etc.)
4) minimum 80 "particles" (e.g. beads, wooden clothes pegs, nuts, washers, etc.)
5) NO FOOD ITEMS.

Rules and Remarks:

1. The wave generator must be at least 2 m long.
2. The cross bars must be at least 20 cm in length. **CAUTION: BE EXTRA CAREFUL WITH HANDLING SKEWERS DUE TO SHARP POINTS!**
3. The cross bars must be spaced no greater than 5 cm apart.
4. Each end of the cross-bars must have a "particle" attached.
5. The wave generator must have a handle at each end. (e.g. rope, string, additional cross bars).
6. The wave generator will function as a medium for mechanical wave propagation, and the student must be able to measure the wave speed as it travels the entire length, reflects, and returns to the starting point.

Project Turn-in:

- Absent students should arrange to have projects dropped off in the front office with student name and teacher's name attached to it; otherwise, a zero will be earned on the project grade. The project must be date stamped by front office personnel.
- Projects are due when the tardy bell rings; any projects not in class or not complete at that time will **not be accepted**.
- Any student earning a zero on the project may take the 9-weeks comprehensive retake to replace the zero on the major project.

Lab Procedure (completed during class on Thursday, May 11)

1) Demonstrate a standing wave. Teacher will provide a clamp to fasten the wave machine to a table.
2) Calculate speed based on distance and time.
3) Perform three trials and calculate average speed.
4) Calculate wavelength and frequency of the first five harmonics.

Calculations (completed during class on Thursday, May 11)

$v = f\lambda$ $\quad v = \frac{d}{t}$ $\quad f = n\frac{v}{2L}$

d= distance traveled (m) $\quad f$ = frequency (Hz) $\quad t$ = time (s) $\quad v$ = magnitude of velocity (speed) (m/s)
λ = wavelength (m) $\quad$ L=length of vibrating string or air column (m) $\quad$ n=harmonic number

trial	distance (cm)	time (s)	speed (cm/s)
1			
2			
3			
Average			

harmonics	frequency (Hz)	wavelength λ (m)
1st		
2nd		
3rd		
4th		
5th		

Grading:

Criteria	NO	YES
The wave generator is completely constructed, functions as a medium for mechanical wave propagation, capable of wave speed measurement from starting point to end, and constructed from required materials.	**0**	**1.0**
The completely constructed wave generator is at least 2 m long.	**0**	**0.5**
The completely constructed wave generator includes at least 40 cross-bars that are at least 20 cm in length.	**0**	**0.5**
The completely constructed wave generator has a functional handle installed at each end.	**0**	**0.5**
The measurements and calculations from demonstrating a completely constructed and functional wave generator includes distance, time, and speed. The results are complete and plausible.	**0**	**1.0**
The measurements and calculations from demonstrating a completely constructed and functional wave generator includes wavelength and frequency. The results are complete and plausible.	**0**	**1.0**
Upon turn in, the owner of the completely constructed and functional wave generator demonstrated the project while following all scientific lab rules. The student participated fully with all required wave demonstrations and measurements as instructed by the teacher.	**0**	**0.5**

Final Grade _____/5.0