Student Name:_____

Teacher's Name:_____

Bendigo Senior Secondary College

Victorian Certificate of Education 2000

Physics

School Assessed Coursework: Outcome 1
Total: 40 marks

Formula

Speed of sound	$v = f\lambda$
Sound level	$L = 10\log\frac{I}{10^{-12}}$ or $L = 10\log I + 120$

Question 1. Measuring Sound Levels

a. From your logbook identify 3 different sounds that you observed, the loudest, the quietest and one between these two.

Complete the following table for the three sounds.

	Description of sound	**Sound level (dB)**	**Intensity ($W.m^{-2}$)**
quietest			
middle			
loudest			

b. Show all your working, perform the following calculations:-

i. Convert 45dB to sound intensity ($W.m^{-2}$)

ii. Convert 4.7×10^{-7} $W.m^{-2}$ to sound level (dB)

(3+4=7 marks)

PHYSICS Unit 3 – OUTCOME 1

Question 2. Intensity of Sound

A logbook from a physics student tabulated the following results:-

Distance (m)	Sound Level (dB)	Intensity ($W.m^{-2}$)
0.8	82	1.6×10^{-4}
1.0	80	1.0×10^{-4}
2.0	74	2.5×10^{-5}
4.0	68	6.3×10^{-6}
5.0	66	4.0×10^{-6}

a. Using the grid below draw a graph of intensity vs distance for these results

b. Using the grid below draw a graph of intensity vs $1/(\text{distance})^2$ for these results

c. Using your graphs, or otherwise, what is the intensity at 3.0 m from the sound source?

d. Write down a mathematical relationship that can be derived from these graphs.

(2+4+2+2=10 marks)

Question 3. Interference

You performed an experimental activity observing and measuring an interference of sound waves in two dimensions in which you were able to detect regions of soft sounds (nodal lines).

When Mary and Bill performed the same experiment and they had the speakers 2.4 m apart both producing the same frequency of 510 Hz.

If the speed of sound was 340 $m.s^{-1}$, and they recorded the following results:-

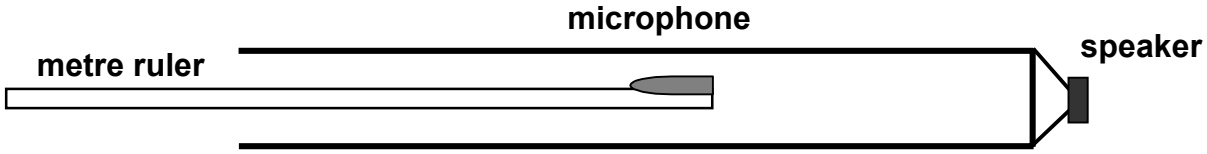
Distance from Speaker 1 (m)	Distance form Speaker 2 (m)
3.06	4.70
4.51	6.20
6.15	7.80

Determine on which nodal line they were standing (1^{st}, 2^{nd}, 3^{rd}, 4^{th}, etc) when they took their results, showing working out to justify your answer.

(6 marks)

Question 4.

Kylie and Brian performed an experiment that determined the location of soft sounds (nodes) along a tube with a speaker at one end producing a sound of constant frequency.



They obtained the following results:-

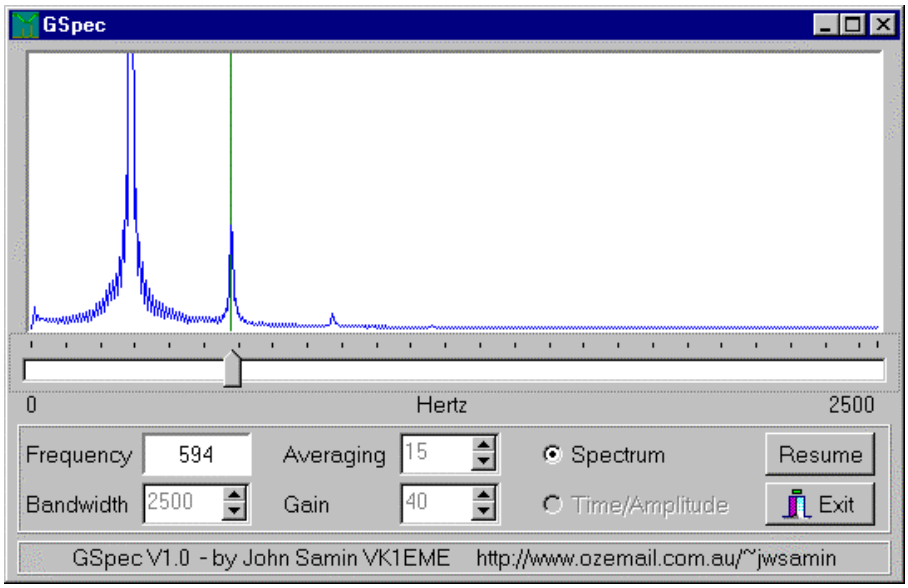
Node position from end of tube (cm)	Node
24.7	A
50.1	B
75.3	C

Given that the speed of sound was 335 $m.s^{-1}$ when they performed the experiment, calculate the frequency that the signal generator was set to.

(5 marks)

Question 5. Harmonics

Two physics students, Jane and Jarrod, observed the following frequency spectrum when performing an experiment with a travelling transverse wave in a vibrating wire. They were able to identify the fundamental (1st harmonic), the 1st overtone (2nd harmonic) and the 2nd overtone (3rd harmonic).



a. What was the frequency of the 1st overtone (2nd harmonic)?

b. What was the frequency of the fundamental (1st harmonic)?

c. Using the speed of the travelling transverse wave in a wire that you calculated in **your** investigation, calculate the length of the vibrating wire used by Jane and Jarrod.

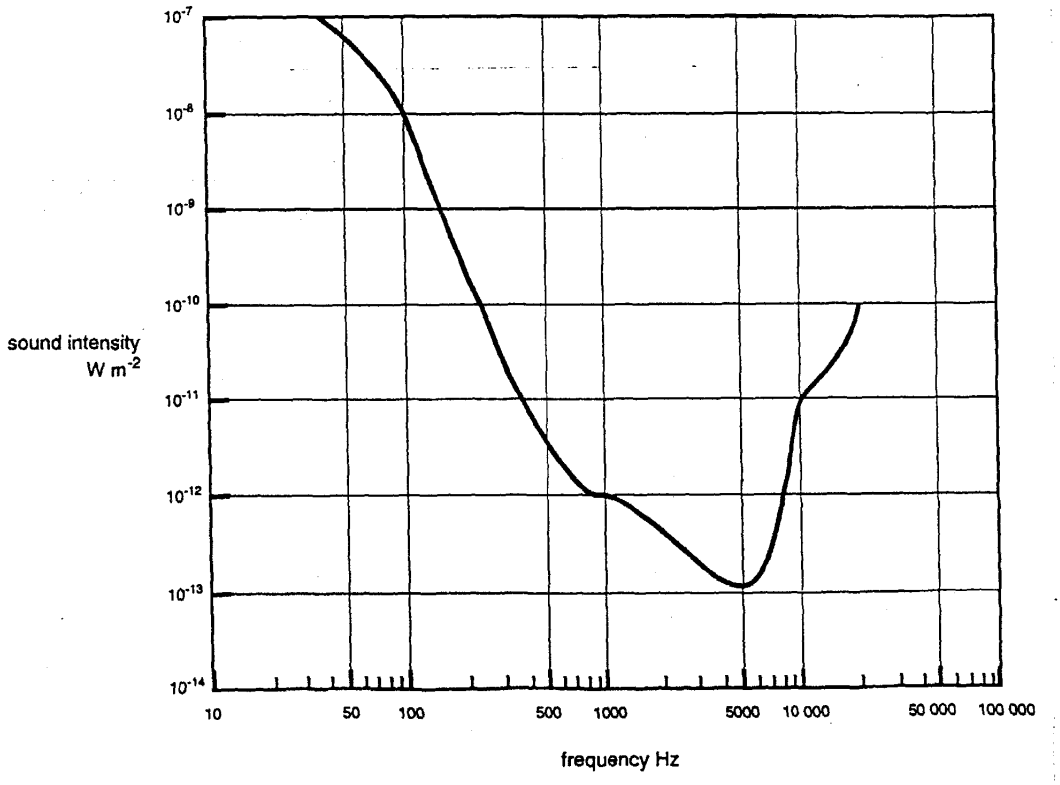
(2+3+4=9 marks)

Question 6. Hearing Response

The intensity at the ear for which sound can just be heard is determined over the entire frequency range. The minimum audible response (threshold of hearing) looks like the curve shown below.

The vertical scale is in units of $W.m^{-2}$ and the horizontal scale in units of Hz.

Note that both axes have logarithmic scales.



If a series of sounds ranging in frequency from 50 Hz to 20,000 Hz are produced at an intensity of 1.0×10^{-11} $W.m^{-2}$, what frequencies will the person be able to hear?

(3 marks)