Name:_____

Assignment due:

St Patrick's College, Silverstream

PHYSICS

Waves Homework Assignment 2

Level 3

90520 Demonstrate understanding of wave systems

Credits: Four

Answer **ALL** the questions in the spaces provided.

If you need more space for any answer, use the pages provided at the back of this booklet and clearly number the question.

For all numerical answers, full working should be shown and the answer should be rounded to the correct number of significant figures and given with an SI unit.

For all 'describe' or 'explain' questions, the answer should be in complete sentences with all logic fully explained.

You may find the following formulae useful

$$d \sin\theta = n\lambda \qquad n\lambda = \frac{dx}{L} \qquad f' = f\frac{v_w}{v_w \pm v_s}$$

$$v = f\lambda \qquad f = \frac{1}{T}$$

NZIP 2008

QUESTION ONE

John was investigating equipment in the back of the lab and found a set of wooden pipes that looked like organ pipes. The pipes were open at both ends.

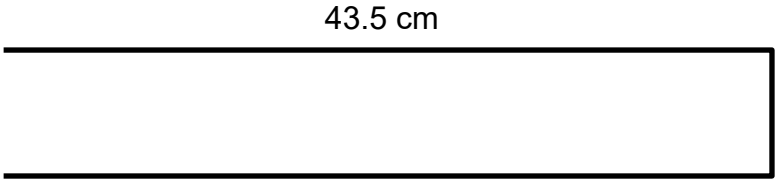
(a) The diagram below shows an open pipe. Draw in the fundamental wave shape.

(b) He measured the length of one of the pipes and it was it was 43.5 cm long. Calculate the wavelength of the fundamental wave in this pipe. Give your answer to the correct number of significant figures.

(c) John put his finger over the end of the pipe to make it a closed end pipe and blew across the open end making it emit a note. In what way is the fundamental note produced from the pipe when it is closed at one end different from the fundamental note that is produced from the same pipe when it is open at both ends? Explain your answer.

(d) John blew the pipe again; still with one end closed, but this time he blew hard enough to produce the 1st overtone (3rd harmonic).

(i) Draw the 1st overtone (3rd harmonic) wave shape into the diagram of the closed pipe below.



(ii) Calculate the frequency of this overtone (harmonic).

(e) John later found two tuning forks marked 522 Hz and 510 Hz. He sounded them both at the same time.

(i) What beat frequency is heard when the forks are sounded together?

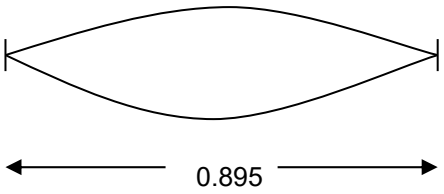
(ii) Explain in detail how beats are produced.

Asses sor's use only

NZIP 2005

QUESTION ONE: STANDING WAVES

The diagram below shows an acoustic guitar. The guitarist makes musical notes by strumming the guitar strings and making them vibrate. The second string from the top is **0.895m** long. When made to vibrate it produces a note of **426Hz**.



(a) The diagram on the right shows the mode of vibration of the string. Describe the type of wave formed on the guitar string.

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(b) Calculate the wavelength of the wave on the guitar string.

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_____ Wavelength = _____

(c) Calculate the speed of the wave along the guitar string.

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_____ Speed = _____

(d) The guitarist now produces a note of **1090 Hz** by pressing the string down against the neck of the guitar. Calculate the length of the string that vibrates when it produces the note of 1090 Hz.

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_____

_____Length = _____

(e) The frequency of the note produced by a guitar string is usually altered by changing the length of the string that vibrates. State two other factors that can alter the frequency of notes produced by guitar strings. Explain how they affect the frequency.

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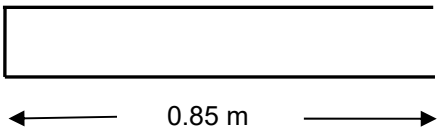
An organ pipe is a wind instrument. It is a one-end closed pipe that contains a column of air. When the air column is made to vibrate it produces a musical note.



(f) In the above diagram, sketch the fundamental standing wave formed in the pipe.

(g) Calculate the **wavelength** of the wave when the air column is vibrating in the fundamental mode. The length of the pipe is **0.85m**.

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_____ Wavelength = _____

(h) The speed of sound in air is **330ms^{-1}**. Calculate the frequency of the third harmonic produced by the pipe.

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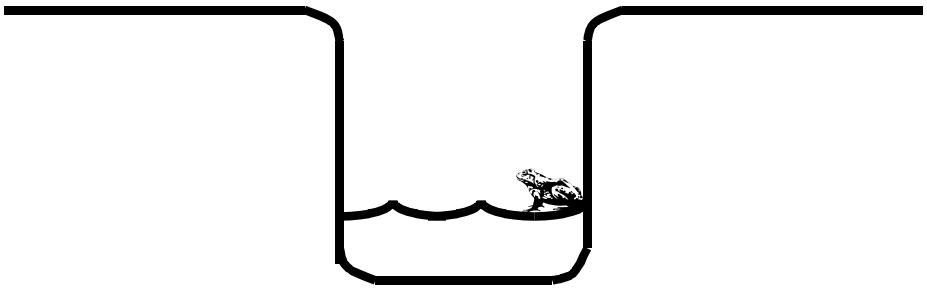
_____ Frequency = _____

NZIP 2004

QUESTION ONE: FROG IN THE HOLE

The Bornean Tree Hole Frog makes its mating call in a hollow filled with water. This allows the song to carry further than if the frog was in the open.



(a) The frog is taking advantage of a physics phenomenon or principle. Name this.

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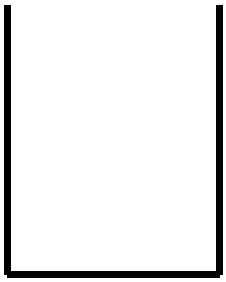

The hollow in the picture acts like a tube closed at one end.

(b) Complete the diagram to show the simplest standing wave that can be produced in the hollow.

The hole is 0.640m deep.

(c) Show that the fundamental frequency of the frog's song is 129Hz. (The speed of sound in air is 330 ms^{-1})

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(d) State the frequency of the third harmonic that will be heard.

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After a heavy rain the level of water in the hollow rises.

(e) Explain how the frog can compensate for this change?

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A researcher studying Tree Hole Frogs moves the frog into an open-ended, hollow log which is also 0.640m long.

(f) Explain why the fundamental frequency of the frog's song in the log would be different to the fundamental frequency in the hole.

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