Name:_____

Assignment due:

St Patrick's College, Silverstream

PHYSICS

Waves Homework Assignment 3

Level 2

AS 90254

2.3 Demonstrate understanding of wave phenomena

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.

For Assessor's use only

Achievement Criteria

Achievement	Achievement with Merit	Achievement With Excellence
Identify or describe aspects of phenomena, concepts or principles. ☐	Give descriptions or explanations in terms of phenomena, concepts, principles and/or relationships. ☐	Give concise explanations that show clear understanding, in terms of phenomena, concepts, principles and/or relationships. ☐
Solve straightforward problems. ☐	Solve problems. ☐	Solve complex problems. ☐
Overall Level of Performance (all criteria within a column are met) ☐		

Formulae that you may find useful are given below

$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$	or	$S_i S_o = f^2$
$m = \frac{d_i}{d_o} = \frac{h_i}{h_o}$	or	$m = \frac{f}{S_o} = \frac{S_i}{f}$
$n_1 \sin\theta_1 = n_2 \sin\theta_2$		$\frac{n_1}{n_2} = \frac{v_2}{v_1} = \frac{\lambda_2}{\lambda_1}$
$v = f\lambda$	$T = \frac{1}{f}$	$v = \frac{d}{t}$

QUESTION ONE: FINDING PEACE

Malcolm prefers to watch the fireworks show without the sound of the explosions so he has made a silence machine that uses interference to cancel the noise. The silence machine is comprised of a microphone, a processor and a large loudspeaker.

(a) Explain how this machine can cancel the sound of the explosions. You may want to draw a diagram in the space provided.

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The display features a section where two identical rockets are exploded simultaneously. Malcolm's brother Dewey finds that by walking around he can find quiet spots. He needs no silence machine.

(b) Explain why there are louder and quieter places when two rockets explode simultaneously.

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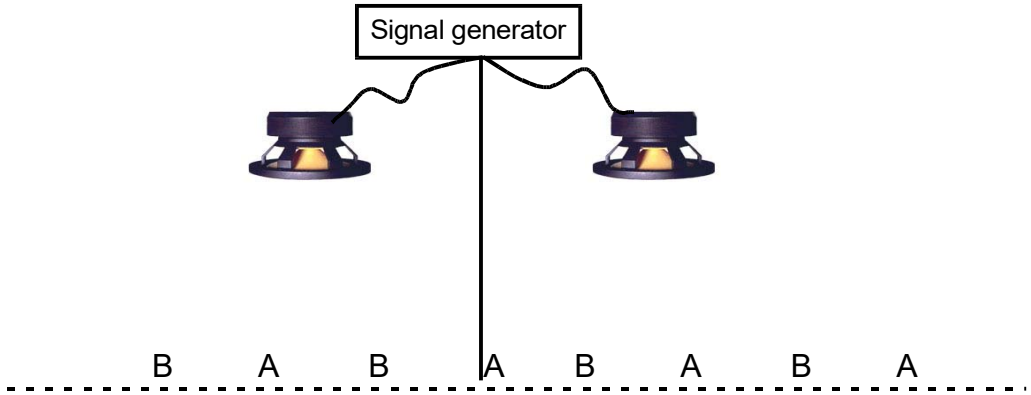
QUESTION TWO: SOUND WAVES

Susan and Maatai are investigating the behaviour of sound waves. They place two identical speakers some distance apart. They then connect them to a signal generator to produce sound waves that are in phase and of the same frequency.



Maatai now walks across the floor in front of the loudspeakers and he notices that the intensity of the sound repeatedly increases and decreases.

(a) State the name of the **phenomenon**.

_____

(b) Explain why the intensity of the sound changes.

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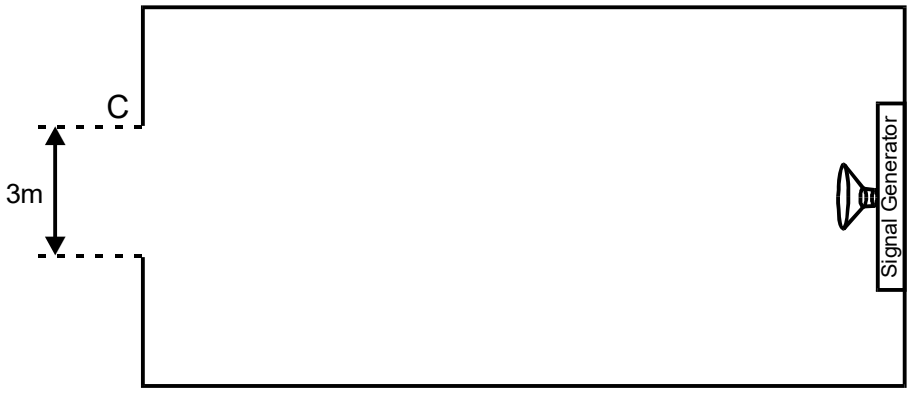
Maati disconnects one speaker and asks Susan to stand outside the hall at C near the open doorway while the other speaker is still operating.



Assessor's use only

(c) The period of the speaker cone is 5.0 x 10^{-4} s. The speed of sound in the air is 330 ms^{-1}. Calculate the wavelength of the waves produced by the speaker in the air.

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Wavelength = _____

He now changes the frequency from **1000 Hz (**λ = 0. 33 m) to **100 Hz** (λ = 3.3 m). Susan hears the sound because of the **diffraction** of the sound waves.

(d) State which frequency diffracts the most and explain why.

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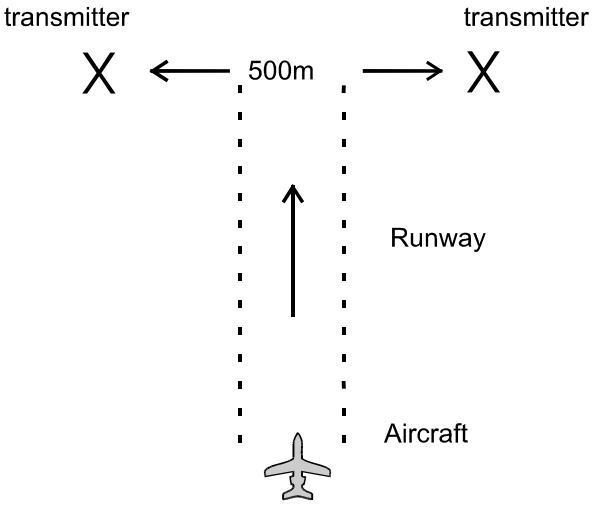
QUESTION THREE: THE TRIP HOME

After their boat trip Janet and Brad fly back to their hometown. Being a foggy day the pilot uses the principle of interference to locate the airport runway. The airport has two radio transmitters equal distances of 250 m from the centre of the runway as shown below. Each transmitter emits radio signals, in phase, of frequency 1.0x10^9 Hz.



(e) The speed of the radio waves is 3.0×10^8 ms^{-1}. Calculate the wavelength of the waves coming from the transmitters.

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wavelength = _____

(f) Calculate the period of these waves in microseconds (one microsecond = 1.0×10^{-6} s). Give your answer to the correct number of significant figures.

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period = _____

(g) When the plane is approaching in line with the middle of the runway he will receive signals of maximum intensity. Explain why.

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(h) Explain a possible source of danger, which could result from using this interference system, if the aircraft is attempting to land in poor visibility and is off course.

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