Name:_____

Assignment due:

St Patrick's College, Silverstream

PHYSICS

Waves Homework Assignment 1&2

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: FIREWORKS DISPLAY

Malcolm and Rona watch a fireworks display on their trip to Wellington. As each rocket explodes a **flash** is seen and a low pitched **bang** is heard.

(a) Which of these is experienced first by Malcolm and Rona?

_____

(b) Describe **two** important differences between sound and light waves.

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The time difference between the bang and the flash is 3.0 seconds. The speed of sound in air is $330ms^{-1}$.

(c) Calculate how far away they are from the exploding fireworks.

_____

_____

_____ Distance = _____

(d) Calculate the wavelength of the sound heard if the frequency is 160Hz.

_____

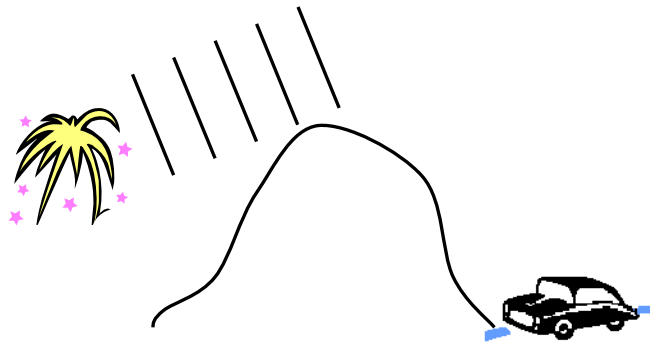
_____ Wavelength = _____

(e) Calculate the Period of the sound waves.

_____

_____ Period = _____

Hal is stuck in traffic with a hill between him and the fireworks display.



(f) Name the phenomenon that allows him to hear the bangs.

_____

(g) Explain why he can hear but not see the fireworks display.

_____

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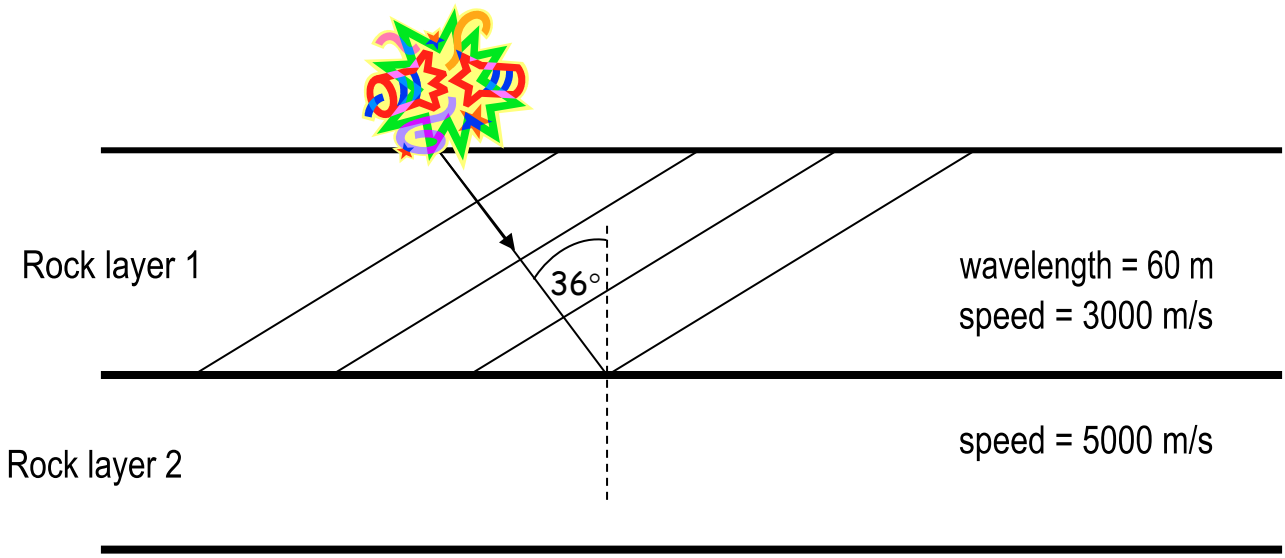
ASSIGNMENT 2

QUESTION ONE: FINDING EXPLOSIVES

While Malcolm and Dewey are finding peace, Rona finds a cache of fireworks. She blows them up on the ground. The sound of the explosion travels through the ground, passing through various layers of rock.



(a) Draw an arrow on the diagram above to show the direction of the sound waves travel in rock layer 2.

(b) Draw in the refracted wavefronts in rock layer 2.

(c) Calculate the wavelength in rock layer 2.

_____

_____

_____

_____ Wavelength = _____

(d) Calculate the angle of refraction of the waves.

_____

_____

_____

_____ Angle = _____

(e) Calculate the angle of incidence that will cause total internal reflection of the sound waves.

_____

_____

_____

_____ Angle on Incidence = _____

QUESTION TWO: SPEAR FISHING

Jack notices that the wavelength of water waves in the river increases as they move from a shallow region to a deeper region of water.

(a) Explain why the wavelength of the water waves **increases** as they move from a shallow region to a deeper region of water.

_____

_____

In the shallow region the frequency of the waves is **2.20 Hz** and the wavelength of the waves is **0.21 m.**

(d) Calculate the **velocity** of the waves. Give your answer to the correct number of significant figures.

_____

_____

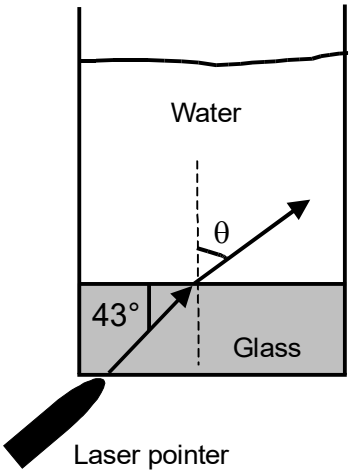
_____

Velocity of waves = _____

Assessor's use only

QUESTION THREE: REFRACTION

A fine beam of red laser is shone from a laser pointer onto the bottom of a thick-bottomed glass with some water in it as shown in the diagram below. The light is incident on the glass-water interface at **43°**, as shown below. The refractive index of glass is **1.51** and that of water is **1.33**.



(c) The speed of red laser light in water is **2.26×10^8 ms^{-1}** and its frequency is **5.64×10^{14} Hz**. Calculate the wavelength of the red laser light in glass.

_____

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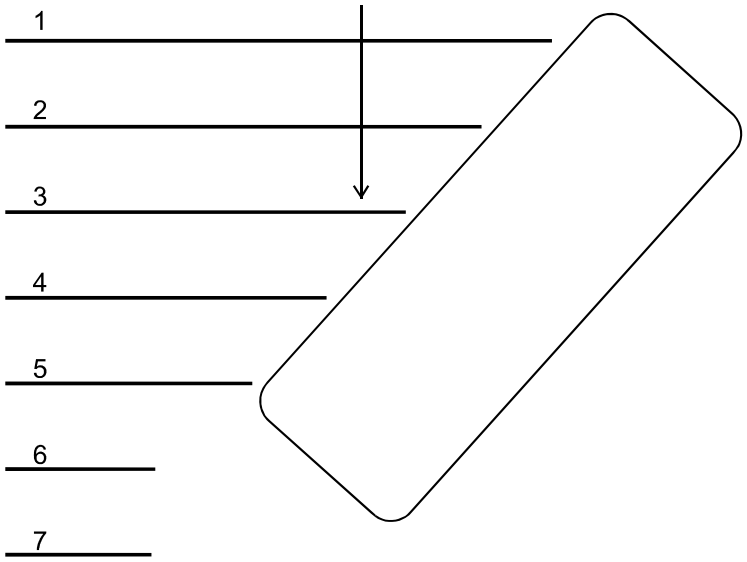
_____

Wavelength = _____

Assessor's use only

QUESTION FOUR: THE SWIMMING HOLE

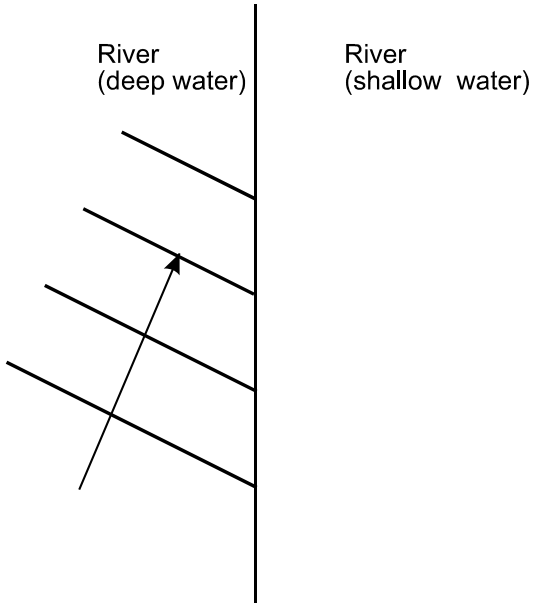
Near the swimming hole is a river that the competitors are required to cross. Brad and Janet move a large fallen tree trunk into the water. The water laps on its sides, as shown in the diagram below.



(a) On the diagram above:
(i) draw in the **direction** of the reflected waves
(ii) draw the reflected crests for incident crests 3, 4 and 5.

(b) On the same diagram above, complete wave crests 6 and 7 to show how they diffract past the end of the tree trunk.

As the waves came close to shore they pass from a deep region into a shallow region.



(c) State what happens to the frequency of the waves as they travel into the shallow region.

_____

_____

(d) Describe what happens to the wavelength of the waves as they pass into the shallow region. Explain your answer.

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(e) Complete the diagram above to show the wave fronts passing into the shallow region.